JUNE 1959

American
1859 Centennial Year 1959
Gas Journal
ONLY MAGAZINE EDITED EXCLUSIVELY FOR THE GAS DISTRIBUTION INDUSTRY

PROGRESS REPORT

The "Never Leak" Method for Internally Sealing Gas Mains

SPECIAL PANEL REPORT

INCREASING EXISTING SYSTEM CAPACITY

Four companies relate their approaches on "how to get more from what you have"

Construction Equipment Pictorial

Photo-report on latest in construction equipment for gas distribution companies exhibited at A.G.A. Distribution Conference in Cincinnati

WHEREVER YOU NEED BIG CAPACITY AT LOW PRESSURE

—AT SHOPPING CENTERS, MOTELS, SCHOOLS, ETC.,

YOU CAN USE THIS METER WITH PROFIT

ROCKWELL "750" Single Joint ALUMINUM METER

It's "made to measure" for you!

Light in weight, the Rockwell "750" is easy to carry and easy to install. Set this workhorse meter inside or out. The sturdy, pressure cast case resists weathering as well as the knocks and bumps that endanger meters made of thinner gauge materials. Repairs are a cinch, too. There's only one joint to break and all working parts can be lifted and replaced as a unit. For catalog describing the "750" and our complete line of aluminum meters, write to Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

Capacity: 750 cfh at ½" pressure differential
Weight: only 47 lbs.

ALUMINUM GAS METERS

another fine product by

ROCKWELL

The only complete line of ALUMINUM METERS

Be sure and see Playhouse 90, GEM sponsored TV program . . . Check your local paper for time and station.

1859 1959
CENTENNIAL YEAR

American Gas Journal

ONLY MAGAZINE EDITED EXCLUSIVELY FOR THE GAS DISTRIBUTION INDUSTRY

SEP 26 1960

PILOT.. ..LIGHTS

Last Lap on a Century

To the mile runner or the Memorial Day racing driver at the Indianapolis Speedway, the last lap is the pay-off . . . and everything prior to that is just preliminary to the finish. The last lap is something of a major achievement . . . drawing the last burst of speed . . . aiming for the big finale.

We wish to point with pride that this issue is the "last lap" for American Gas Journal on a century of continuous service to the gas industry. *But unlike the foot and auto races, there is no "last lap" and big finale in the business of issuing a publication.* Month in and month out, there are always "small" finales called *deadlines,* yet there is always another issue to look forward to preparing . . . news to gather . . . articles to edit . . . current and long range subjects to study and discuss . . . ideas to evaluate . . . and service to perform.

Next month, ye olde American Gas Journal begins its 101st year . . . we look forward to providing our second century of service to the industry.

*

Dig This!

Operating men from gas distribution companies attending the A.G.A. Distribution Conference in Cincinnati got a first hand look at the latest in construction equipment, vehicles, etc. On hand for the affair were members of the AGJ staff, who brought back a complete photo-report. Equipment displayed and demonstrated is pictorially presented on page 41.

*

DO IT NOW!

Advance reservations for the 1959 Gas Handbook Issue of AGJ are now being accepted. In fact, on the reader service card of this issue (just inside back cover) you'll find details on a special 15 months for $3.00 offer that includes your personal copy of the forthcoming new HANDBOOK ISSUE. Regular subscribers (who get the Handbook Issue each year as part of the subscription) can also take advantage of this offer to extend their current subscriptions. AND, if you are reading this paragraph in a "borrowed" or "pass-along" copy, why not order your own personal subscription . . . and BE SURE that you get a copy of the 1959 GAS HANDBOOK ISSUE? The new issue will have more than 200 pages of up-to-the-minute data on every phase of operations. Reserve yours now!

Volume 186 **June 1959** **Number 6**

IN THIS ISSUE . . .

INDIANAPOLIS MAY 29 1959

SPECIAL REPORT:

How To Increase Capacity of Existing Systems

- **In Philadelphia:** *Time-Temperature Loaders, Telemetering Used In Three-Phase Program on Three-Pressure System* 22
- **At Consumers Power:** *Appliance Regulators, Remote Control, and Time-Cycle Pressure-Boosting Increases Capacity* 26
- **In Detroit:** *Service Regulators, Elevated Pressures Help Meet Michigan Consolidated's Expansion Needs* 29
- **In St. Louis:** *Additional District Regulators and Temperature-Boosters Prove Practical* 31

OPERATIONS & MANAGEMENT

"Never Leak" Method for Internal Sealing of Gas Mains 18
Consolidated Edison terms results of new sealing method of bell and spigot joints as "gratifying" . . .

Gas-Fired Furnaces Speed Meter Repair Soldering 34
Soldering iron furnaces play important role in expediting meter maintenance at Northern Illinois Gas Co.'s new $500,000 meter shop

New Plastic Coupler Helps Solve Insulating Problem 38
New compression type coupler for insulating service line connections helps prevent corrosion due to stray currents

Toward Better Management:
How Effective Are You As a Manager? 39
Here's a simple checklist of qualities that other gas industry executives think are important to effective supervision

CONSTRUCTION

Construction Equipment Pictorial 41
Photo-report on latest equipment for gas distribution companies, displayed at A.G.A. Distribution Conference in Cincinnati

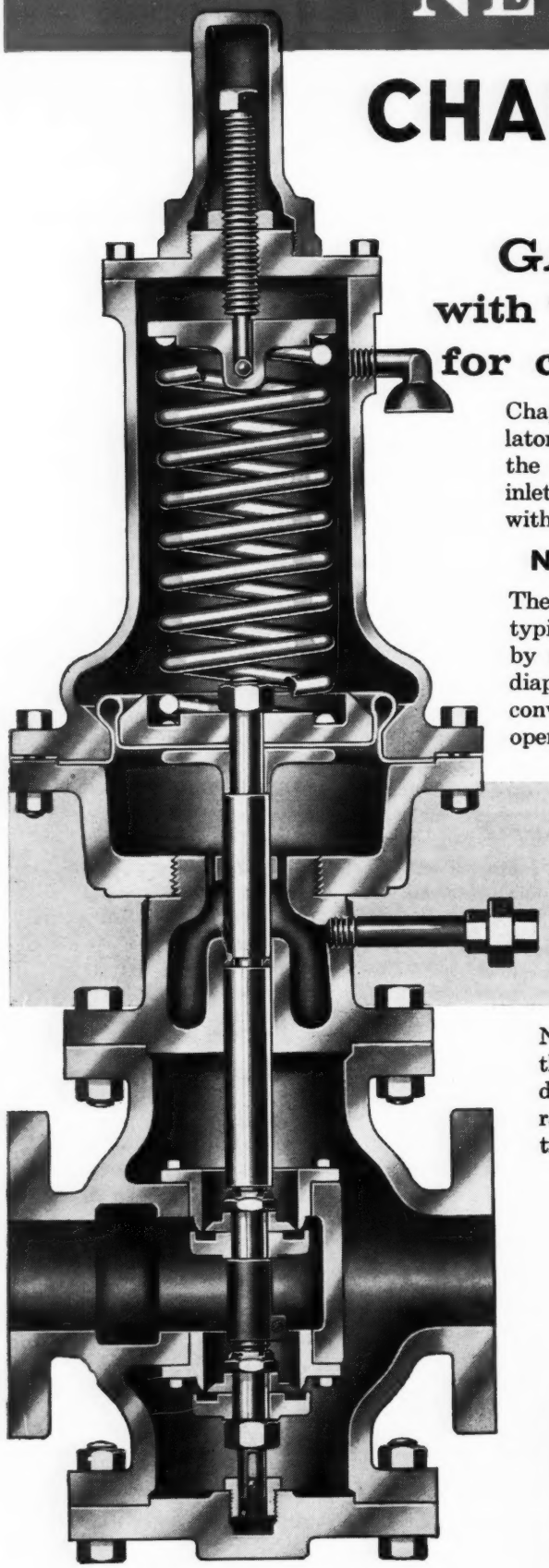
Distribution Developments 46
News about current distribution construction projects

FEATURES & DEPARTMENTS

MCF — News Hilites 3
Men At Work: *News about people you know* 14
Professional Directory: *Guide to engineering and consulting services* . . . 36
Calendar of Coming Events in the Gas Distribution Industry 17
Product Parade: *New talking gaslite can page guests, play music* 47
Bookshelf: *New technical manual contains comprehensive weather data* 50
Industry Newsreel: *Hall of Flame adds six new members* 51
Bulletin Board: *Free data on new products* 56
Advertisers' Index: *Your guide to suppliers of quality products* 55

AMERICAN GAS JOURNAL is a registered trademark. Entire contents of this issue copyrighted. Reproduction of any part without permission of copyright owner is strictly prohibited.

NEW IN PRINCIPLE!
NEW IN DESIGN!



CHAPLIN-FULTON

Model 57-S

GAS REGULATOR

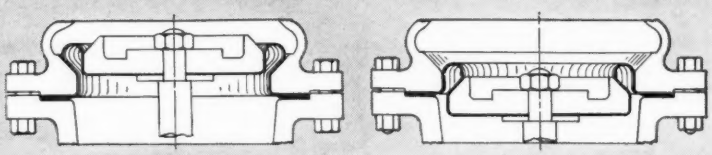
with "ROLL-OUT" Diaphragm for constant pressure control

Chaplin-Fulton Model 57-S is a simple spring loaded regulator which performs like a pilot loaded regulator, without the added complications. For pounds-to-pounds service—inlet pressures to 400 psi—controlled pressures to 75 psi, with deviation through full valve travel less than 1 psi.

NO "FALL-OFF" AS FLOW INCREASES

The drooping characteristics or outlet pressure "fall-off", typical of conventional spring regulators, is eliminated—not by using an uncontrollable velocity effect—but by a new diaphragm design which actually reverses the action of a conventional diaphragm. It changes its area as the valve opens to compensate for the loss in spring loading force.

"ROLL-OUT" DIAPHRAGM PRINCIPLE



VALVE CLOSED VALVE OPEN

Note how, with the valve upwards in the closed position, the diaphragm achieves its maximum effective area—and decreases as the valve opens. The area changes at the same rate as the spring loses compression, to give a constant controlled pressure—determined entirely by valve movement.

2" - 3" - 4" - 6"

Write for Bulletin 57-S

ACCURATE CF MFG. CO. DEPENDABLE

Chaplin-Fulton

MANUFACTURING COMPANY

Pittsburgh 25, Pennsylvania

AMERICAN GAS JOURNAL

1859 1959

Dean Hale
Editor
Pat Loar
Assistant Editor
Ernestine Adams
Economics and Management Editor
Jan Craig
Editorial Production Manager
Donald D. Fickert
Presentation Editor
Lynn Patton
Editorial Assistant
Cecile Pincus
Editorial Assistant

•

Joe B. Woods
President and Publisher
Abbott Sparks
Vice President and Advertising Director
E. V. Perkins
Vice President and Western Manager
J. E. Kastrop
Director of Editorial
L. H. Johnston
Secretary-Treasurer

•

Allen K. Tyler
Production Manager
Glen D. Hebert
Assistant Production Manager
Paul J. Mansfield
Advertiser Services Manager
Charles McKean
Circulation Director
Royal Courtney
Circulation Fulfillment Manager
Sherwood R. Entwistle
Circulation Promotion Manager

•

NEW YORK: **John L. McDonald, Clyde Dillehay**
52 Vanderbilt Ave., MUrray Hill 6-7232
CHICAGO: **E. V. Perkins, Robert T. Mahoney**
53 West Jackson Blvd., HArrison 7-6883
LOS ANGELES: **Richard P. McKey**
465 East Union, Pasadena, RYan 1-0685
PITTSBURGH: **Art G. Gilliam**
121 Ambleside Dr., WEllington 1-0619
BIRMINGHAM: **Fred W. Smith**
1201 Forest View Lane, Vesthaven, TRemont 1-5762
HOUSTON: **Jess Adkins**
2370 Rice Blvd., Room 110, JAckson 6-2631
DALLAS: **Ed Sealey**
800 Davis Bldg., RIverside 8-4403

Cable Address: PEPUB

Member Audit Bureau of Circulation and Associated Business Publications. Copyright, 1959, The Petroleum Engineer Publishing Co., Dallas, Texas. Subscription Rates: U.S. and Canada $3.00 per year; $5.00 two years. South American and Foreign $5.00 per year; $10.00 two years. Single copies, $1.00 except August 15 Handbook issue not sold separately. Please send subscription correspondence and change of address to American Gas Journal, P. O. Box 1589, Dallas 21, Texas. Subscribers should notify publisher promptly of any change of address, giving old as well as new address, and including city postal delivery zone, if any. If possible, enclose an address label from a recent issue of the magazine. Allow one month to six weeks for change to become effective.

Printed in U.S.A.

M C F

NEWS HILITES OF THE INDUSTRY

Natural gas discoveries are keeping up with increases in usage, declares an FPC official. Testifying before a closed session of a House appropriations sub-committee, Carl T. Kallina, chief of the FPC bureau of rates and gas certificates, said the nation is not running out of gas and that new gas fields are being found. Kallina cited A.G.A. estimates, pointed out that reserve life for natural gas was estimated at 21.4 years based on 1957 production and that discoveries have just about reached a balance point with use. Kallina also indicated he favored importing gas to protect domestic reserves.

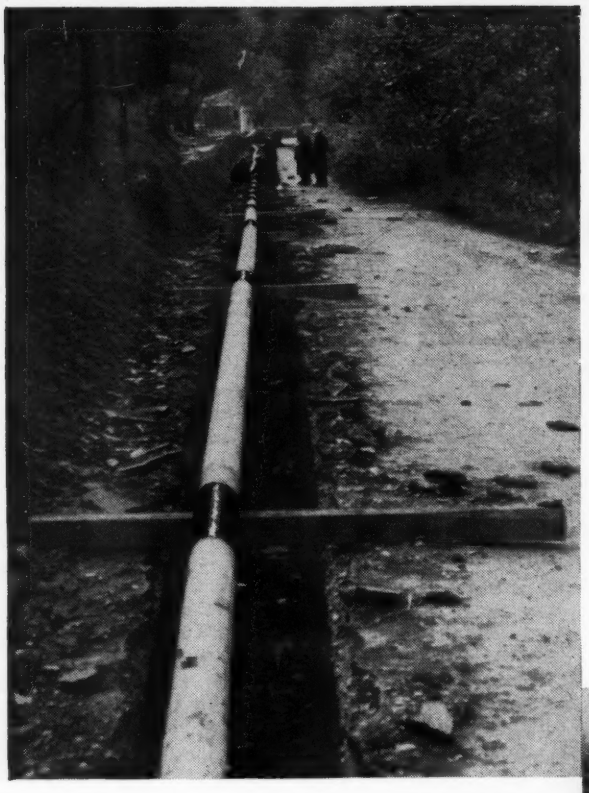
Thomas Edison, the "father of electricity," probably wouldn't mind but it undoubtedly irked present day promoters of electricity to note that the streets of the Llewellyn Park section in West Orange, New Jersey, where Edison lived nearly a half-century, are still lit with the soft glow of gas lights. During National Electrical Week, an observance honoring Edison and designed to "enhance public appreciation of electricity," the gas lights remained brightly lit as they have been since 1916. Edison invented the electric light bulb in 1879, but the device has not yet invaded the area — and probably won't, says an area spokesman, who noted, "We don't want these 'modern' electric street lights. We have enough overhead wires as it is."

First direct conversion of heat from a nuclear reactor into electricity took place in April at the AEC's Los Alamos Scientific Laboratory. A record 17 percent efficiency was developed by the unique "plasma thermocouple" (American Gas Journal, April 1959, Page 54), which delivered about 130 watts of d-c power to light a lamp for 12 hours.

A "national fuels policy" obviously designed to bolster the sagging economic condition of the domestic coal industry — including coal producers, coal labor, coal users, and coal railroads – was boomed at a big dinner in Washington recently with members of Congress as special guests. **Common theme of the coal dinner speeches — coal is suffering from unfair competition from gas and oil.** One obvious intent of the get-together – a national fuels policy to help the coal industry (even though it would not be at all suitable to the oil and gas industry). Possible approach: Combination of coal's interests with the "government planners" who fervently love to plan for planning's sake, regardless of the result. *Not pointed out at the dinner: Coal is perfect example of an industry that has almost priced itself out of business.*

Twenty-nine communities in northern and central Wisconsin —as well as other American Natural Gas System customers — will be using Canadian gas if approval by FPC and Canadian officials can be secured for a contract signed recently by Michigan Wisconsin Pipe Line, American Natural subsidiary, and Midwestern Gas Transmission Company. Contract terms call for purchase of 158,000,000 cu ft of gas daily to be imported from Trans-Canada Pipe Lines through Midwestern lines. In addition to obtaining 79 percent of the initial import by Midwestern, Michigan Wisconsin also has right to buy 75 percent of all future additional Canadian gas imported by Midwestern. Deliveries by Trans-Canada would be made at a point on the U. S.-Canadian border directly south of Winnipeg. Midwestern would construct approximately 500 miles of 24-in. to central Wisconsin, where gas would be delivered to Michigan Wisconsin near the town of Marshfield. Communities along the line's route would be supplied gas by Midwestern. Total cost of Midwestern facilities is estimated at $54,000,000; total construction cost by Michigan Wisconsin, $41,000,000.

AMERICAN GAS JOURNAL, June 1959, Vol. 186, No. 6. Published monthly except August, then semi-monthly by The Petroleum Engineer Publishing Company, P. O. Box 1589, Dallas, Texas. Second class mail privileges authorized at Dallas, Texas. Executive and Editorial Offices at 800 Davis Building, P. O. Box 1589, Dallas 21, Texas.



Cut Maintenance and Replacement Costs with TAPECOAT®

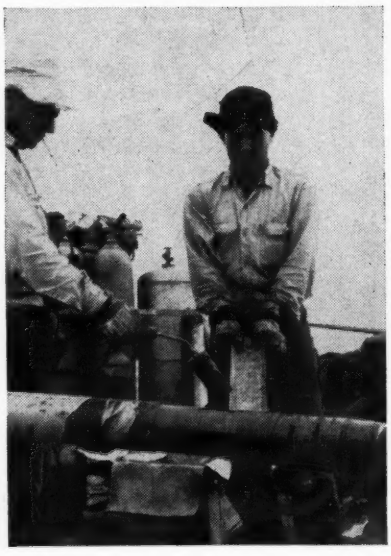
...the Coal Tar Tape Coating that Adds Years of Service Life to Gas Lines

No wonder more and more distribution engineers are selecting TAPECOAT products as an important part of their program in fighting underground corrosion! Experience shows that quality protection applied during installation prevents huge maintenance and replacement expense at later dates.

Since 1941 when TAPECOAT originated coal tar coating in tape form, it has proved to be the best protection money can buy for combatting corrosion underground or under water. Lines in service TAPECOATED as far back as 17 years ago show no signs of deterioration – a record of uninterrupted service no other type of tape can match.

TAPECOAT comes in rolls of 2″, 3″, 4″, 6″, 18″ and 24″ widths–sized to the job for protecting pipe, pipe joints, couplings, fittings, tanks, conduit, cable and tie rods. TAPECOAT is both bond and protection in one–easy to apply with the flash of a torch.

Write for brochure today.



When primer is specified, use TC Primecoat, the compatible coal tar primer.

The TAPECOAT Company

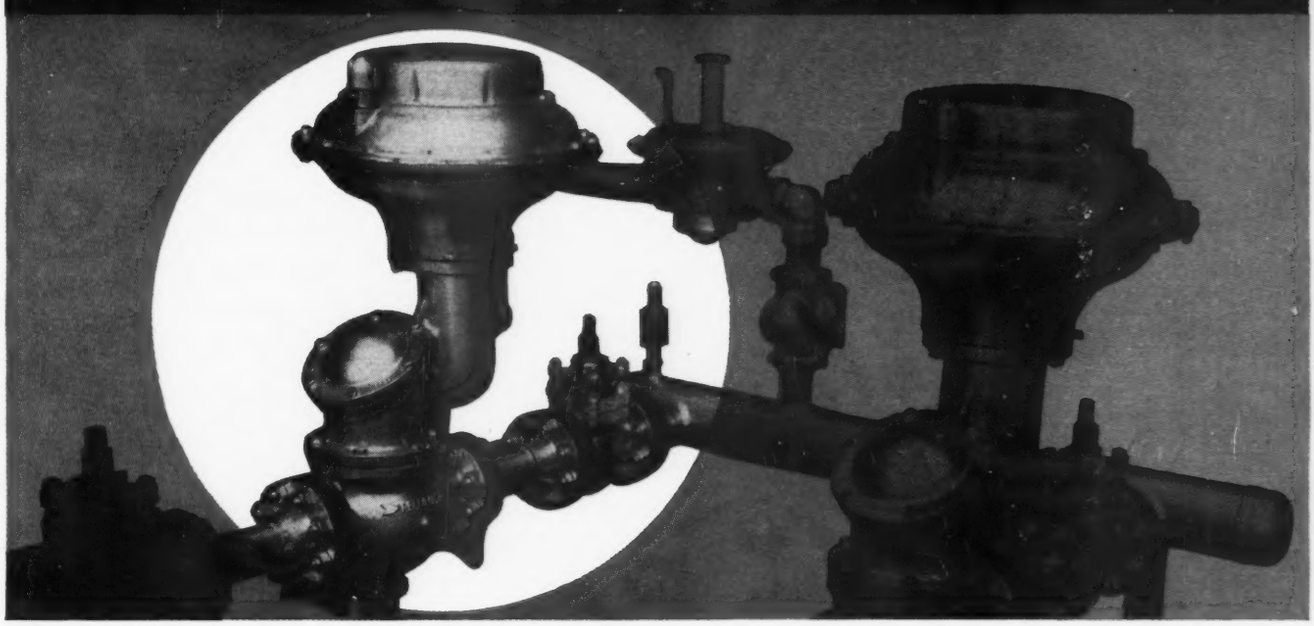
1567 Lyons Street, Evanston, Illinois

Representatives in Principal Cities

Manufactured and distributed in Canada by The Tapecoat Co. of Canada, Ltd., 25 Haas Road, Rexdale, Ontario

Reliance

Regulators



RUGGED–EFFICIENT–STABLE–DEPENDABLE

Illustrated is a typical Reliance gas distribution installation for low pressure regulation. Reliance CBV-300 regulators are designed for low-pressure, pounds-to-ounces applications in industrial services and intermediate pressure distribution systems. Fully enclosed, this offset-connected type is ideal for vaults, regulator pits, or where pilot loading or pressure boosting is employed.

Other applications include low pressure pilot loading downstream bleed, low pressure pilot loading and boosting, back pressure, and high pressure pilot loading atmospheric bleed.

For outlet pressures from 3 to 42 inches water column.

Write for bulletins containing complete specifications.

AMERICAN METER COMPANY
INCORPORATED (ESTABLISHED 1836)

AMERICAN METER CO MEASUREMENT ENGINEERS

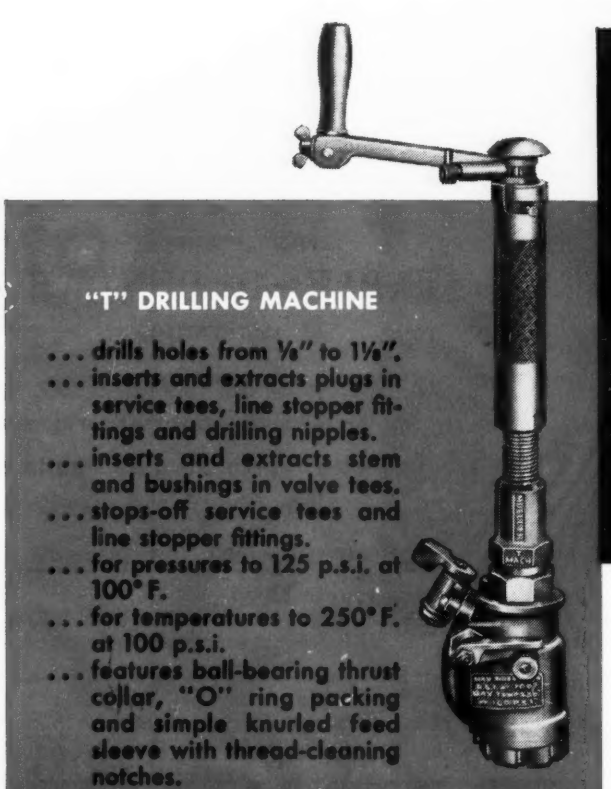
RELIANCE REGULATOR DIVISION
ALHAMBRA, CALIFORNIA

use the compact MUELLER "T" Machine to connect services under pressure QUICKLY SAFELY SIMPLY

MUELLER NO-BLO Method

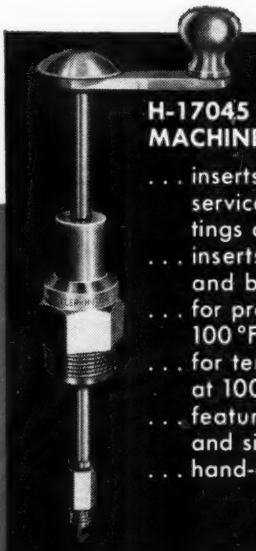
■ Make fast service connections by equipping your crew with a Mueller "T" Drilling Machine and H-17045 Completion Machine. Both of these machines are extremely light-weight and compact—ideal for use when many service connections must be made on a "mass production" basis!

Here is shown the few simple operations needed to quickly make an all-welded ¾" service connection to a steel distribution system with a No-Blo Service Tee.



"T" DRILLING MACHINE

- . . . drills holes from ⅛" to 1⅛".
- . . . inserts and extracts plugs in service tees, line stopper fittings and drilling nipples.
- . . . inserts and extracts stem and bushings in valve tees.
- . . . stops-off service tees and line stopper fittings.
- . . . for pressures to 125 p.s.i. at 100° F.
- . . . for temperatures to 250° F. at 100 p.s.i.
- . . . features ball-bearing thrust collar, "O" ring packing and simple knurled feed sleeve with thread-cleaning notches.
- . . . hand-operated.



H-17045 COMPLETION MACHINE

- . . . inserts and extracts plugs in service tees, line stopper fittings and drilling nipples.
- . . . inserts and extracts stem and bushings in valve tees.
- . . . for pressures to 125 p.s.i. at 100 °F.
- . . . for temperatures to 250° F. at 100 p.s.i.
- . . . features "O" ring packing and simple crank handle.
- . . . hand-operated.

These machines are typical of the attention to detail in research, design and engineering that becomes a part of all Mueller No-Blo fittings and equipment produced for the gas industry.

1. WELD

Remove cap and plug and weld tee to main. Weld service line to tee and complete line to curb or meter stop.
Test weld with soapsuds and air pressure.

2. ATTACH

Attach control chamber to tee and open flop valve.

3. ASSEMBLE

Assemble proper drill to "T" machine and attach machine to control chamber.

4. DRILL

Drill hole into main.
Retract boring bar and close flop valve.
Remove "T" machine.

5. PLUG

Attach completion plug to shaft of H-17045 completion machine and attach machine to control chamber.
Open flop valve and screw plug firmly into tee.
Release plug from shaft of machine and remove machine and control chamber.

6. CAP

Screw completion cap solidly on tee and test for leakage.

NOTE: Future stop-offs of the service line at the main may be made at any time by inserting a rubber or steel shut-off tool into the tee with the "T" machine. However, if frequent shut-offs are to be made, we recommend installing No-Blo Valve Tees. These tees have a built-in valve that may be quickly operated with an ordinary screwdriver and wrench.

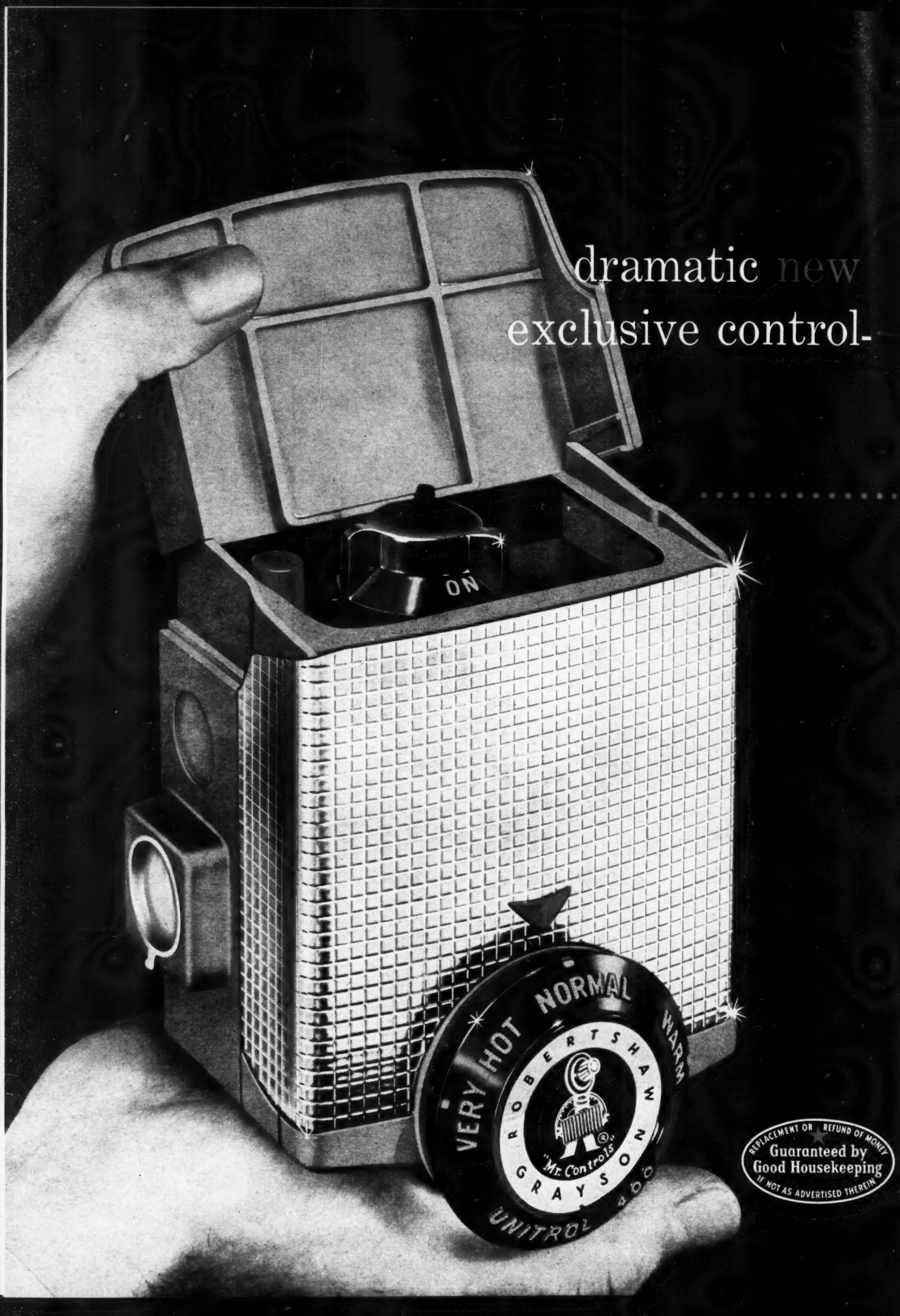
MUELLER CO. since 1857 SERVING the Water and Gas Industries QUALITY

GEM GAS EQUIPMENT MANUFACTURERS GROUP MEMBER

MUELLER CO.

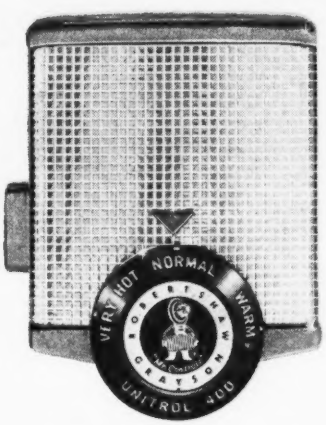
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

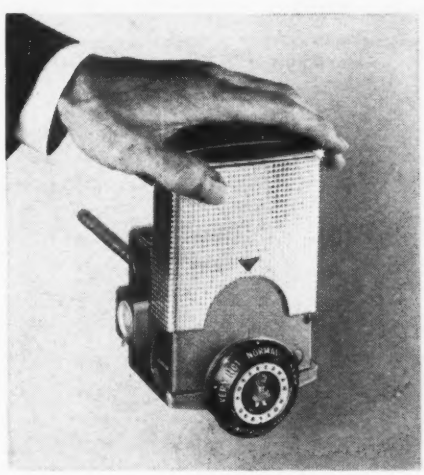

dramatic new
exclusive control-
ON
VERY HOT
NORMAL
WARM
ROBERTSHAW
"Mr. Controls"
GRAYSON
UNITROL 400
REPLACEMENT OR REFUND OF MONEY
Guaranteed by
Good Housekeeping
IF NOT AS ADVERTISED THEREIN

ROBERTSHAW **UNITROL 400R** provides a new, selling feature you never had before...

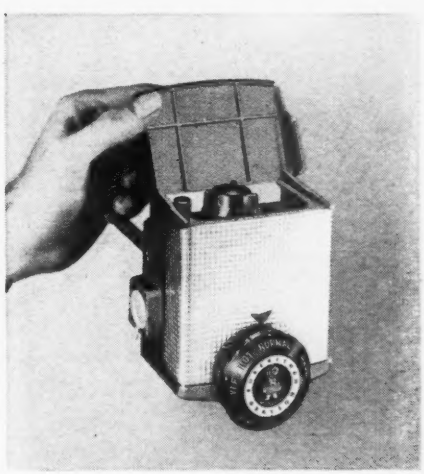
....DEMONSTRATION



DEMONSTRATE the most beautiful control in the world!



DEMONSTRATE the exclusive new slip-top cover!



DEMONSTRATE the exclusive new flip-top lid!

Show customers the Unitrol 400R with the slip-top cover and the flip-top lid... *for greater water heater sales*

Equip your water heater with the control which will help sell it...the new Robertshaw Unitrol 400R! The lid flips up, and the whole cover slips off for easy pilot lighting. Here is a control your sales people can *demonstrate* to customers...here is a control which will enhance your water heater's ability, utility, recovery capability (the Robertshaw Unitrol 400R features a built-in pressure regulator) and reliability!

The Robertshaw Unitrol 400R will help you sell your top line water heaters or raise the sales of lower priced heaters!

FOR MORE INFORMATION CONTACT:

Robertshaw

GRAYSON CONTROLS DIVISION • LONG BEACH, CALIFORNIA

A *NEW* INDUSTRIAL GAS

with *Dyna-Balance*—Built especially for tough commercial and industrial applications

FISHER Type 166

has large capacity and precision performance characteristics

- **A fully balanced inner valve provides absolute tight shutoff at low lockup pressure.**
- **All inner valve parts easily removable through blind flange without removing regulator from the line.**
- **Unusually large capacity throughout its performance range.**
- **Shock resistant! Controlled pressure holds constant even with snap acting solenoid valves opening and closing in downstream system.**

CONSTRUCTION DATA

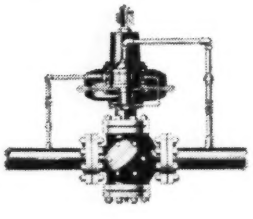
It is available in two constructions—**Type 166-1** has 1" diameter ports and is available with 1½" or 2" screwed and 2" 125-lb. flanged bodies.

Type 166-2 has 1⅞" diameter ports and body size is 2" screwed or 2" 125-lb. flange. The pressure ranges are:

Type 166-1—Inlet up to 125 psi
Outlet 4" W.C. to 10 psi
(7 different springs available)

Type 166-2—Inlet up to 60 psi
Outlet 3" W.C. to 5 psi
(6 different springs available)

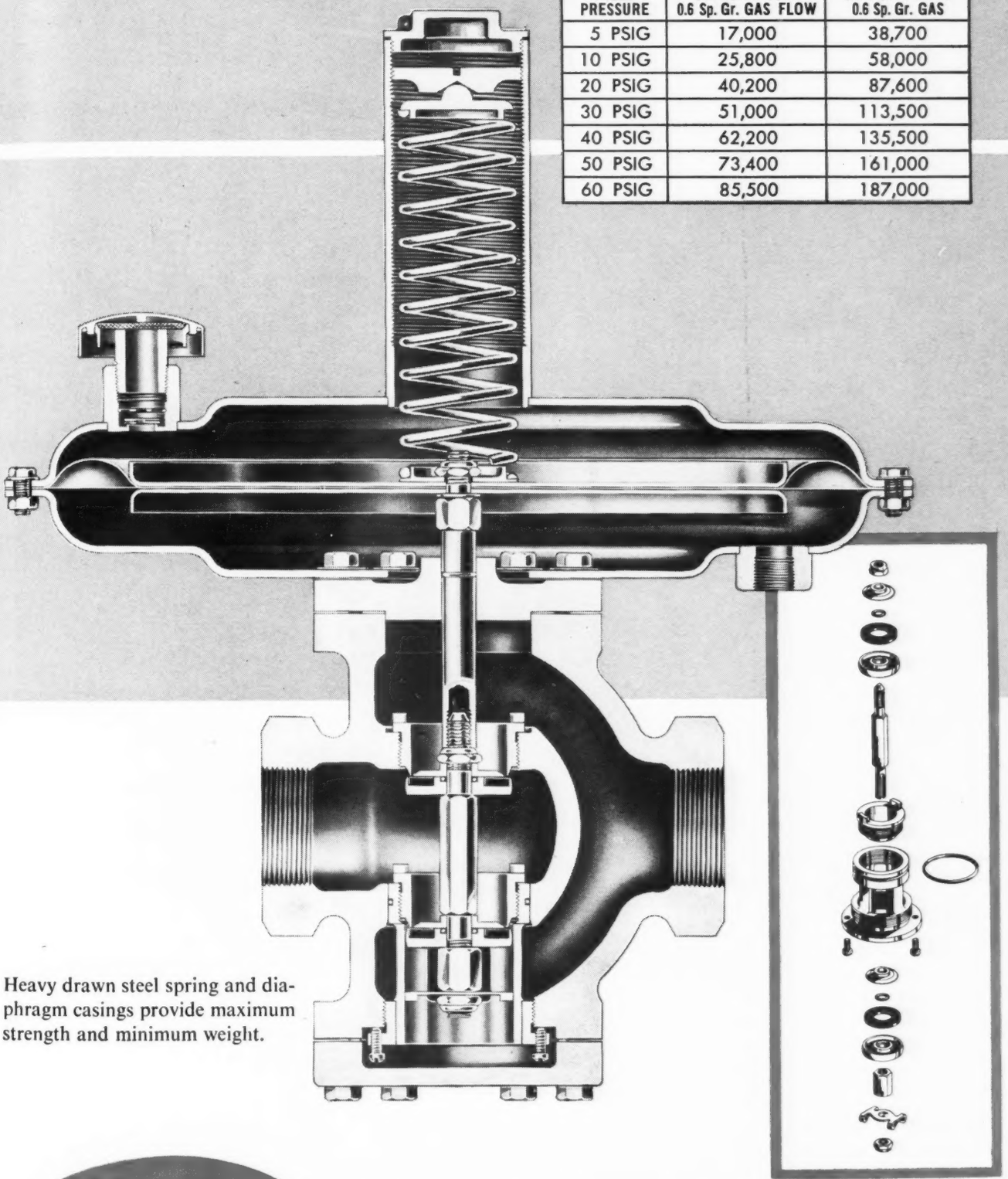
Commercial and industrial installations requiring greater gas volume have long needed a heavy duty regulator such as the new balanced Fisher Type 166. Talk about high capacity—the 166 has it! For example, the Type 166-2 with 1-⅞" ports will pass 38,700 CFH of gas with a 5 psi inlet and a 7" water column outlet. Inner valve incorporates a "Dyna-balance" effect to boost outlet pressure with increasing flow. Send for Fisher Bulletin P-166.



IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .

REGULATOR

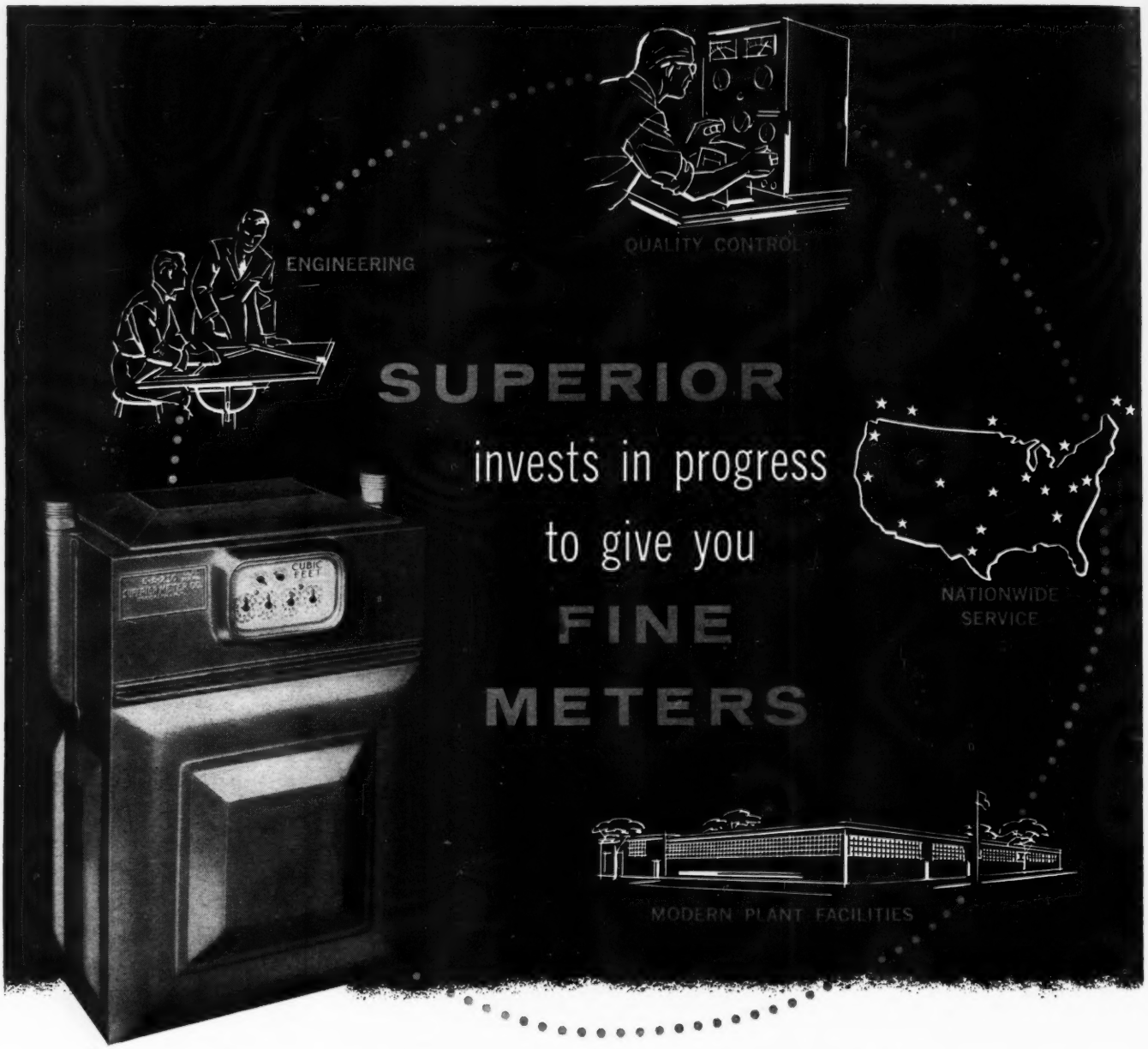
OUTLET PRESSURE = 7″ W.C.		
	TYPE 166-1	TYPE 166-2
INLET PRESSURE	CAPACITY SCFH 0.6 Sp. Gr. GAS FLOW	CAPACITY SCFH 0.6 Sp. Gr. GAS
5 PSIG	17,000	38,700
10 PSIG	25,800	58,000
20 PSIG	40,200	87,600
30 PSIG	51,000	113,500
40 PSIG	62,200	135,500
50 PSIG	73,400	161,000
60 PSIG	85,500	187,000



Heavy drawn steel spring and diaphragm casings provide maximum strength and minimum weight.

FISHER® Controls
SINCE 1880

FISHER GOVERNOR COMPANY
Coraopolis, Pa. / Woodstock, Ontario / London, England
Main Office and Plant: MARSHALLTOWN, IOWA



A larger staff of respected meter engineers...quality control specialists...nationwide sales and service... modern, high-precision machine tools . . . a brand new plant turning out the advanced-design Superior aluminum case meter, also the well-known tin case meters...that's the Superior Meter Company of today, now part of Neptune Meter Company, one of the world's major meter and instrument groups.

For Superior customers this means meters of sustained, fine-instrument accuracy, the result of one of the finest combinations of men, methods and machines. It also means a representative in your area who understands your needs and gives you service when you want it.

You now get more, at no extra cost, when you specify "Superior", the meter of enduring accuracy.

For Quality Meter Repairing and Repair Parts...
Superior maintains meter repair shops with rigid standards of quality control as an addition to your own facilities. Write or phone today.

SUPERIOR METER COMPANY, INC.
19 West 50th Street, New York 20, N. Y.
A SUBSIDIARY OF NEPTUNE METER COMPANY

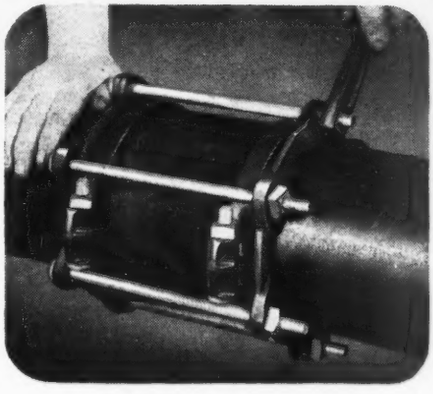
Branch Offices: Atlanta • Boston • Chicago • Dallas • Denver • Los Angeles Louisville • New York • North Kansas City, Mo. • Philadelphia Portland, Ore. • San Francisco

In Canada: Neptune Meters Ltd. • Toronto • Calgary • Halifax Montreal • St. John • Vancouver • Winnipeg

neptune

16

FOR THREAD LEAKS AT FITTINGS



FOR EVERY TYPE OF COLLAR LEAK

SKINNER-SEAL COLLAR LEAK CLAMP, with its sealed *gasket* and massive construction, stops every type of collar leak.

SKINNER-SEAL PIPE JOINT CLAMP for pipe repair permanence. Stops leaks at joints where pipe is screwed into a fitting. Any temperature—pressures up to 2,000 pounds. It saves the cost of tearing out and renewing leaky fittings. Prevents shutdowns. This clamp, constantly improved over the years, has been serving the industry for over half a century. In stock at all supply stores!

M. B. SKINNER COMPANY, SOUTH BEND 21, IND., U. S. A.

PIPE JOINT CLAMP
COLLAR LEAK CLAMP

SKINNER-SEAL

1897 1958

PIPE STOPPERS OF ALL KINDS

•

SAFETY GAS MAIN STOPPER CO. INC.

523 Atlantic Avenue

Brooklyn 17, N. Y.

Cable Address: GASTOPPER, N. Y.

Find it faster with FISHER!

M-SCOPE PIPE FINDER

only $189.50

- Greatest depth penetration
- Greatest tracing distance
- Pinpoint accuracy
- One year between battery changes
- Built-in battery testers
- 90% less maintenance costs

Built for rugged field use: Transistorized circuits, compact fiberglass case.

SEND FOR FREE 1959 CATALOG

FISHER Research Lab., Inc.

Dept. AJ-1, Palo Alto, Calif.

MEN AT WORK

IN THE GAS DISTRIBUTION INDUSTRY

● **Charles Kiel, Jr.,** former manager, operating services department, has been elected vice president, operating services, of Long Island Lighting Co.

Charles Kiel, Jr.

J. H. Long

● **J. Henry Long** has been elected vice president in charge of gas operations for Philadelphia Electric Company. He will be responsible for gas production and distribution in the Bucks, Delaware, Montgomery, and Chester County areas served by the utility. He was previously manager of gas operations.

● **John S. Webb** has been appointed district gas superintendent at Kindersley for Saskatchewan Power Corporation. Formerly gas fitter foreman at Weyburn, Webb will be in charge of natural gas operations at Kindersley and other points in that area to be served in the future. He replaces **Harold Jonasson,** who was recently transferred to the new gas superintendency at Yorkton.

● **Dean H. Mitchell, J. Samuel Hartt,** and **Charles H. Albers** have been reelected directors of Northern Indiana Public Service Company for a 3-year term at the annual stockholders meeting.

● **Kenneth V. Zwiener,** president of Harris Trust and Savings Bank, and **Gilbert H. Scribner, Jr.,** partner in Scribner & Company have been elected to the board of directors of Peoples Gas Light and Coke Company succeeding General **Charles C. Haffner, Jr.,** and the late James S. Knowlson.

● **Harold F. Schulte** has been appointed chief engineer of Wheelabrator Corporation. He has been acting chief engineer since April 1958.

● **Perry F. Roys** has been appointed manager of area development for Northern Natural Gas Company. He was formerly director of the Montana State Planning Board and in the new position he will coordinate activities of Northern's industrial and community development sections.

● **Allen A. Putt,** formerly eastern district manager for the Metalbestos Division of William Wallace Company, has been appointed special representative for the company with headquarters in Washington, D. C.

● Recently elected officers of Natural Gas Distributors, Inc., of Kaukauna, Wisconsin are: **E. H. Schmidt,** president; **J. F. Cota,** vice president and general manager; **B. F. Crawford,** secretary and treasurer; **R. H. Lawrenz,** assistant treasurer, and **W. T. Rieser,** assistant secretary. Directors elected are: Schmidt, Crawford, **L. C. Colman, Milton Falcoff,** and **George Newlin.**

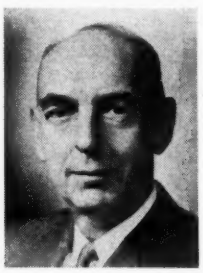
● **Ello H. Richardson** has been promoted to vice president and general manager of the Cambridge Gas Company, a subsidiary of the New England Gas and Electric Association. He has been general manager since 1956.

● **Guy Matheny** has been appointed superintendent of main lines for The Peoples Natural Gas Company of Pittsburgh, Pennsylvania.

● **Frank P. Hyer,** former vice president in charge of engineering, operations, and construction, has been elected president and general manager of Delaware Power & Light Company. **H. H. Plank,** former president and general manager, steps up to chairman of the board of directors. **Stuart Cooper** will continue as a director and chairman of the executive committee. **Harold W. Clift** has been elected vice president in charge of gas and electric operations, and **R. B. Richardson,** vice president, assumes most of the other responsibilities formerly directed by Hyer.

● **Robert Kyle,** former vice president and director of The Gas Machinery Co. of Cleveland, has joined Commonwealth Services, Inc., as a senior consultant with headquarters in New York.

Robert Kyle



M. H. Cutler

● **M. H. Cutler,** former assistant engineering manager, has been named engineering manager of Stone & Webster Engineering Corporation succeeding **Fred W. Argue** who was recently named executive vice president of the company. In a series of other executive shifts, **Thomas A. Fearnside,** chief mechanical engineer, has been named assistant engineering manager, and **Floyd F. Dedrick,** assistant chief mechanical engineer, has been named to succeed Fearnside.

● **Harold I. Gregg** has been appointed new design engineer for J. E. Lonergan Company of Philadelphia.

● **W. M. Hollingsworth,** manager of special products and services for Temco, Inc., has been promoted to the newly-created position of assistant to the president.

● **Edmund C. Austin,** formerly director of purchases, has been appointed to the newly created position of vice president — procurement, for The Fluor Corporation.

● **Walter C. Bomhoff,** vice president and general manager of the Kentucky-West Virginia Gas Company, a subsidiary of Equitable Gas Company of Pittsburgh, has been named to the board of directors of the Second National Bank of Ashland, Kentucky.

H. G. Gibb

G. O. Dickson

● Three recent personnel changes at Ohio Fuel Gas Company include the promotion of **Harold G. Gibb** from general cashier to assistant manager of purchasing and stores for the company. **Gerald E. Laver,** business promotion representative in Lorain, has been named air conditioning specialist in Columbus, and **G. Orion Dickson,** Coshocton business promotion representative, will become a gas advisor in Columbus.

● **John C. Wallace** has been appointed the new president for Walworth Company culminating the 2-year period he has been with the company, in which he has held three vice presidential positions. Most recent of these was vice president and general sales manager. **Harold Brown** has been appointed vice president and general sales manager. **Fred W. Belz,** former president, has been promoted to chairman of the board.

● Board of directors of Michigan Consolidated Gas Company have voted to eliminate the office of chairman of the board and consolidate its duties with those of the president. **Ralph T. McElvenny,** who has been chairman of the board and chief executive officer of the utility since 1954, has been elected president. Elected to the board of directors was **Wilber H. Mack,** executive vice president and director of Michigan Wisconsin Pipe Line Company and the American Louisiana Pipe Line Company, affiliates in the American Natural Gas Company system. Both vacancies were created by the recent death of Henry Tuttle.

● **Earl R. Youngs** has been named treasurer of the Toledo Pipe Threading Machine Company.

Eugene S. George

E. S. George, 69, vice president and director of Houston Natural Gas Corporation, died April 15 in Houston following an extended illness.

Andrew F. Cassidy

A. F. Cassidy, 43, national manager of marketing for Rheem Manufacturing Company, died suddenly of a heart attack April 24.

S. B. Rymer, Sr.

S. B. Rymer, Sr., 79, founder and chairman of the board of Dixie Products, Inc., died in Cleveland, Tennessee, April 4 following a four-month illness. He was a pioneer southern industrialist who established in 1916 the Dixie Foundry Company that later began production and sale of gas ranges.

Paul S. Bartlett

P. S. Bartlett, 54, senior sales engineer for Lancaster Meter Parts Company, died March 21st at his home in Lancaster, Ohio, from a sudden heart attack.

HALLMARKS of QUALITY

CONTACT OUR NEAREST REPRESENTATIVES

C. J. ARNBRECHT, Jr.
5315 Sandra Way
Arvada, Colorado

R. W. KINKER
712 Main St.
Grinnell, Iowa

A. P. BAKER, Jr.
Box 2429
Midland, Texas

ROGER HORNBOSTEL
738 State St.
Chester, Illinois

BASIL SHARP
5763 E. 26th Place
Tulsa, Oklahoma

Since specialization began, the finest craftsmen have stamped their work with symbols that attest to the quality of their products.

Our hallmark of quality coating and wrapping, affixed to the kraft wrapper of your pipe, assures you that the pipe has been treated according to rigid specifications and procedures, Standard Procedures, which establish the highest standard of quality for pipe protection.

standard pipeprotection inc.

3000 SOUTH BRENTWOOD BLVD. • ST. LOUIS 17, MO.

● **Donald B. Robertson** has been named advertising manager at Southern Counties Gas Company, succeeding **Homer Laughlin** recently retired. He was formerly assistant advertising manager.

● **J. Luther Davis** has been elected president of Tucson Gas, Electric Light and Power Company succeeding **J. R. Snyder** who served as president through 13 years of unprecedented growth for the company. Davis, 34, is one of the youngest utility presidents in the country.

● **Edward Niederer, Jr.,** formerly with Pacific Gas Company in Longview, Washington, has been named vice president of Cascade Natural Gas Corporation. He assumes some of the duties of **W. M. Little,** executive vice president of the company who resigned early this year.

● **Cornelius Whetstone,** widely-known equipment merchandising executive, has been appointed marketing manager for Massey-Ferguson Industrial Division, effective April 1. He was formerly general sales manager of Trojan Division of Yale and Towne Manufacturing Company.

● **Richard G. Hume** has joined A. M. Byers Company as a field service engineer in the Pittsburgh regional office. He was formerly chief engineer at DeVries Construction Company of Arlington, Massachusetts.

● **Chester Ludka** has been appointed Norge home appliance district manager for North Carolina, Virginia, West Virginia, and eastern Tennessee. He reports to **John A. Curley,** Norge division manager.

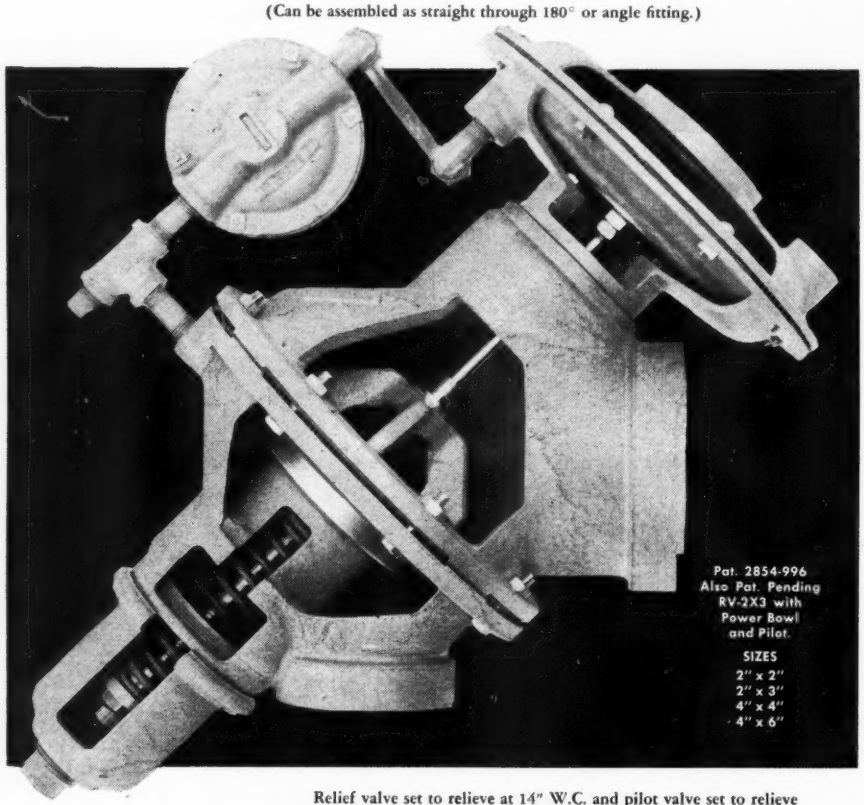
Safety
PLUS PERFORMANCE

A Pilot Operated Relief Valve that will not fail to open because of pilot failure.

With Power Bowl and/or Pilot Relief Valve improves performance with less increase in pressure for same capacity.

Power Bowl available up to 15 pounds—maximum inches W.C. to 50 pounds.

(Can be assembled as straight through 180° or angle fitting.)



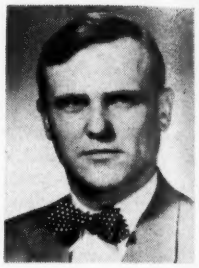
Relief valve set to relieve at 14" W.C. and pilot valve set to relieve at 14" W.C.—when pressure is increased to 24" W.C. capacity of relief valve is 24,000 cu. ft. one hour.

If pilot valve fails the relief valve will operate and pass the same capacity but at a pressure of 1.5 PSI—without the power bowl the same capacity will require 3 PSI outlet.

REYNOLDS GAS REGULATOR CO., INC. *Anderson, Indiana*

A Subsidiary of Arkansas Louisiana Gas Company

R. M. Hetherington



R. C. Judd

● **Robert M. Hetherington,** former assistant to the president, has been elected vice president in charge of operation of Iowa-Illinois Gas and Electric Company. He will be succeeded by **Raymond C. Judd.**

● **Andrew J. Van Hoef,** Michigan Consolidated Gas Company, has been elected chairman of the Midwest Industrial Gas Council. **Frank J. Dawson,** The Peoples Gas Light and Coke Company, has been named vice-chairman, and **Ira J. Roberts,** Northern Indiana Public Service Company, secretary-treasurer.

● **William M. Connor,** assistant to the vice president of Rockwell Manufacturing Company's meter and valve division, has been promoted to general manager of the Statesboro, Georgia, plant. **Samuel W. Brown,** Statesboro general manager, has been transferred to Uniontown, Pennsylvania, plant as assistant general manager to direct the accelerated engineering program there and assist in administration of manufacturing operations.

● **Richard S. Reynolds, Jr.** has been elected chairman of the board of directors of Robertshaw-Fulton Controls Company succeeding **John A. Robertshaw,** who will serve as vice chairman of the board until his retirement June 30. **John H. Krey** has been elected a member of the firm's executive committee. Other executive committee members are **T. T. Arden,** president of Robertshaw-Fulton. and Reynolds, who is also president of Reynolds Metals Company.

● **Arno Elstermann** has been appointed market and load analyst in Saskatchewan Power Corporation's division of statistics and economics. He will undertake natural gas studies, regarding future estimated load growth, energy resources, and market analyses of the corporations' various types of loads and their development.

● **Stuart A. Smith** has been appointed sales manager of furnaces by Perfection Industries, division of Hupp Corporation. He was formerly sales vice president and a director of Waterman-Waterbury Co.

● **Harold E. Sweatt** has been promoted from sales representative to eastern district manager for the Metalbestos Division of William Wallace Company in Woodbridge, New Jersey.

● Buflovak Equipment Division, Blaw-Knox Company, has announced the opening of a sales office in Houston, Texas. **Harold R. Kibby** has been transferred from Birmingham, Alabama, to represent Buflovak at the new location. The new office will be shared by Power Piping Division's regional sales engineer, **J. H. Westberry.**

COMING EVENTS IN THE GAS DISTRIBUTION INDUSTRY

June

1- 5 National Fire Protection Association, annual meeting, Hotels Dennis and Shelburne, Atlantic City, New Jersey.
1- 5 A.G.A. air conditioning sales school, Baker Hotel, Dallas, Texas.
2- 4 Appalachian Underground Corrosion Short Course, West Virginia University, Morgantown, West Virginia.
4- 5 NEGA residential sales workshop, Eastover, Lenox, Massachusetts.
9 NEGA operating division, Worcester Polytechnic Institute, Worcester, Massachusetts.
10-12 NEGA gas measurement and control school, Worcester Polytechnic Institute, Worcester, Massachusetts.
10-12 Instrument Society of America, 2nd international symposium on gas chromatography, East Lansing, Michigan.
12 NEGA Home Service Group, The Tavern, Gloucester, Massachusetts.
14-18 ASME semi-annual meeting, Chase-Park Plaza Hotels, St. Louis, Missouri.
21-26 ASTM, annual meeting, Chalfonte-Haddon Hall, Atlantic City, New Jersey.
22-23 Michigan Gas Association, Grand Hotel, Mackinac Island, Michigan.
22-25 Canadian Gas Association, annual meeting, Empress Hotel, Victoria, British Columbia, Canada.
23 NEGA accounting division, Springfield Country Club, West Springfield, Massachusetts.
25-26 A.G.A. committee on marketing research, Skytop Lodge, Skytop, Pennsylvania.

August

24-26 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, West Virginia.
26-28 Mid-West Gas Association, gas school and conference, Iowa State College, Ames, Iowa.

September

4 New Jersey Gas Association, annual convention, Berkeley-Carteret Hotel, Asbury Park, New Jersey.
9-11 Pacific Coast Gas Association, annual meeting, Hotel Ambassador, Los Angeles, California.
14-15 NEGA, gas utility managers conference, Wianno Club, Osterville, Massachusetts.
14-18 A.G.A. industrial gas school, Penn-Sheraton Hotel, Pittsburgh, Pennsylvania.
15-16 A.G.A. 11th annual accident prevention conference, The Dinkler Plaza Hotel, Atlanta, Georgia.
17-18 A.G.A. Great Lakes public relations workshop, Dearborn Inn, Dearborn, Michigan.
17-19 Public Utilities Association of the Virginias, 41st annual meeting, The Greenbrier, White Sulphur Springs, West Virginia.
20-23 ASME Petroleum Mechanical Engineering Conference, Rice Hotel, Houston, Texas.

GEM
OF THE
OIL AND GAS
INDUSTRY

Lone Star Steel men are specialists . . true craftsmen. Lone Star is not just a steel plant *per se* . . but an organization of craftsmen specializing in fine pipe for the great and growing oil and gas industry.

At Lone Star . . with the finest tools and equipment . . steel craftsmen make API casing, tubing, and line pipe to a precise quality level that is well known.

Lone Star pipe is the gem of the oil and gas industry.

Lone Star STEEL COMPANY

EXECUTIVE—SALES OFFICES
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas
DISTRICT SALES OFFICES
912 Republic National Bank Building, Dallas, Texas
Houston, Texas | Midland, Texas | Tulsa, Oklahoma

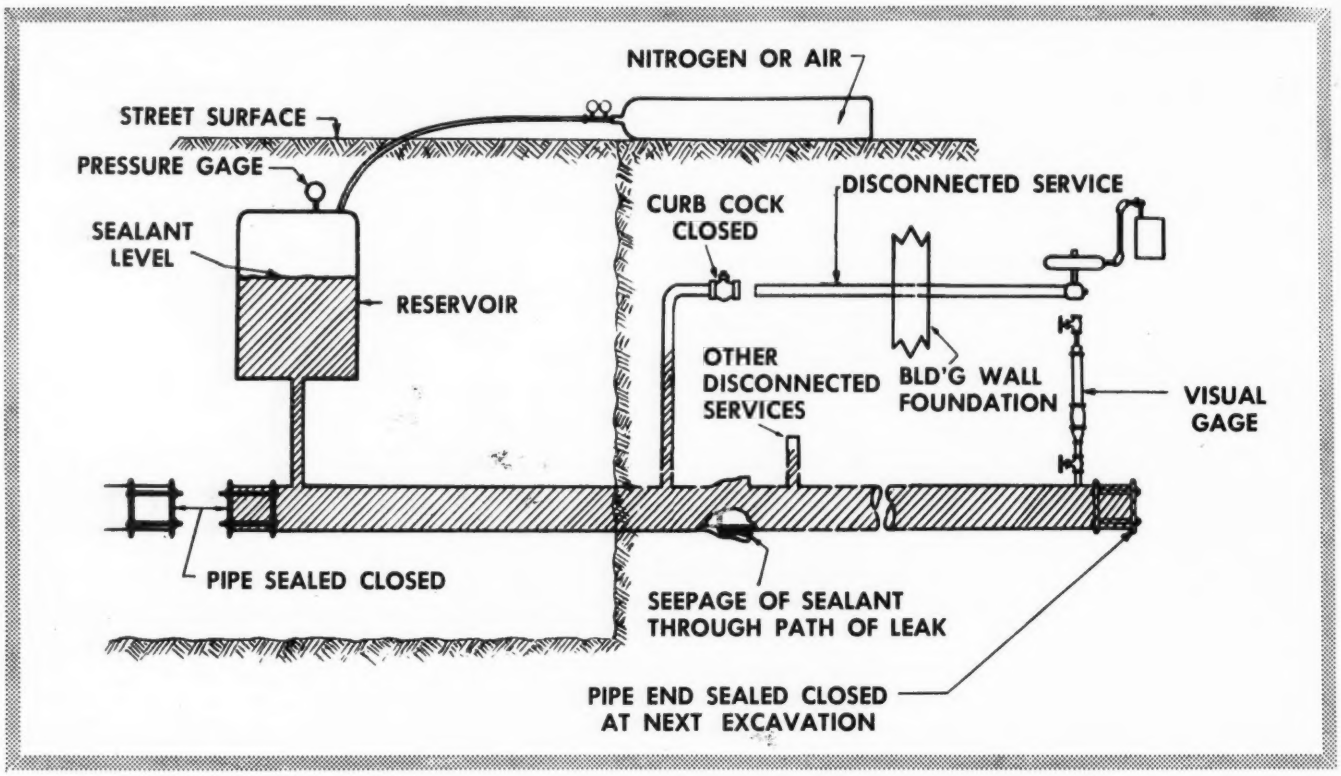


Fig. 1. Schematic diagram of never-leak method of sealing bell and spigot joints on gas main.

Leaking bell and spigot joints successfully sealed, Consolidated Edison terms results "gratifying" . . .

The 'Never Leak' Method For Internal Sealing of Gas Mains

C. P. Xenis, *Engineering Department*
Consolidated Edison Company of New York, Inc.
New York, New York

DURING 1957 AND 1958 extensive use was made of the "never leak" method of internally sealing gas mains in the gas distribution system of Consolidated Edison Company, mainly in the Westchester area. Performance to date, economics, and other considerations have been gratifying. Basic principles, and type of equipment used, and a summary of test results and experience obtained to date are outlined in this article.

Selection of the type of liquid sealant used in the operation was the result of extensive investigation, experimentation, and improvements after trial. It must perform the following functions:

a. The liquid must fill the interstices in the bell and spigot joints, and after drying or curing, leave a permanent filler which seals the paths of gas leakage.
b. Accomplish the sealing operation even though the jute in the joint is partially or completely deteriorated due to the drying effect of natural gas. Indeed the sealing operation must be effective even where the jute is completely absent due to extensive prior deterioration. It must work on cement-filled joints where there is little or no jute.
c. The liquid, upon drying or curing, must leave a thickness of a rubber-like resilient material, chemically and physically unaffected by gas, its components, odorizer, etc.

With the help and cooperation of the suppliers of these materials, these objectives have been met.

The procedure used in the operation required considerable study and development. In its optimum form, as described in this report, it is effective and practical, but requires careful follow-up of every detail and the exercise of care and ingenuity on the part of the foreman in charge of the job.

Basic Concept

Fig. 1 schematically describes the method. A convenient length of cast

iron main with bell and spigot type joints is isolated from the rest of the system, all customer services are shut off, and the main is completely filled with the sealing liquid.

The liquid is introduced into the main with proper venting procedure so as to assure that no air is trapped in any part of the main and, therefore, that it is completely filled with liquid. Liquid pressure is raised to a maximum of 65 psig for mains up to 8-in. diameter. Any small pockets of air trapped in the upper portion of the annular space between the bell and spigot will be compressed to the same pressure as the liquid and, at that pressure, the air is driven out of the joint; this results in complete filling of the pipe and space adjacent to the joints.

The liquid pressure of 65 psig is maintained for at least 1½ hour. The liquid is thus forced into the passages of gas leakage through the joint, partially penetrates the jute that may be present in the joint, and coats the critical surfaces.

Because the liquid is a dispersion containing approximately 40 percent solids, a "filtering" action takes place under pressure, permitting the water and lighter components of the liquid to penetrate deeper into the jute and interstices of the joint while "filtering out" the solid, rubber-like particles on the critical surfaces of the joint that, under operating conditions, are exposed to gas in the main.

These rubber-like solids, upon drying, form an integral elastic seal. This elastic seal has been found to be chemically free from any attack by the gas, any of its components, or the odorizer.

In treating lengths of mains of 1000 feet or more, active leaks are sealed and progressive deterioration of jute in all joints is arrested.

Practical Considerations

This procedure involves an outage to the customers connected to the main being treated, and is completed in one day. Customers have been found to be cooperative in this situation, and so have been the authorities that issue the permits — the reason being that very little traffic interference is involved, compared to conventional leak clamping, which involves a large number of consecutive excavations.

Service shut-offs can be accomplished by disconnecting and capping at the customer's premises, closing valves at the curb or, as usually practiced in Con Ed's Westchester district, cutting and capping each service at the grass strip adjacent to the curb.

After the services are closed, the section to be treated is pressure tested and the gas leakage measured. This provides us with an accurate record as to the amount of gas lost through the leaks and enables us to evaluate the economics involved in saving this gas which, incidentally, more than pays for the cost of sealing.

At the completion of the sealing operation, and before restoring service to the customers, another measurement of gas leakage is made; this provides a good check on the success of the sealing operation.

As stated previously, for the operation to be successful the main must be completely filled with the sealing liquid. Our equipment incorporates visual and pressure type indicators, to assure us proper filling. When the pipe has been completely filled with liquid from the 2000-gal tank, it is pressurized by connecting to a small auxiliary tank that provides a visual indication of further flow of liquid into the line.

By observing indications from pres-

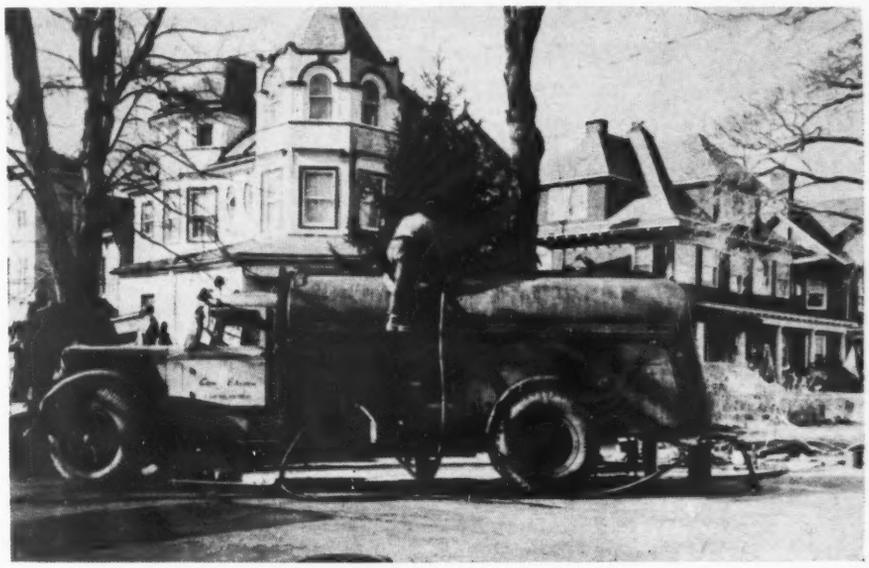
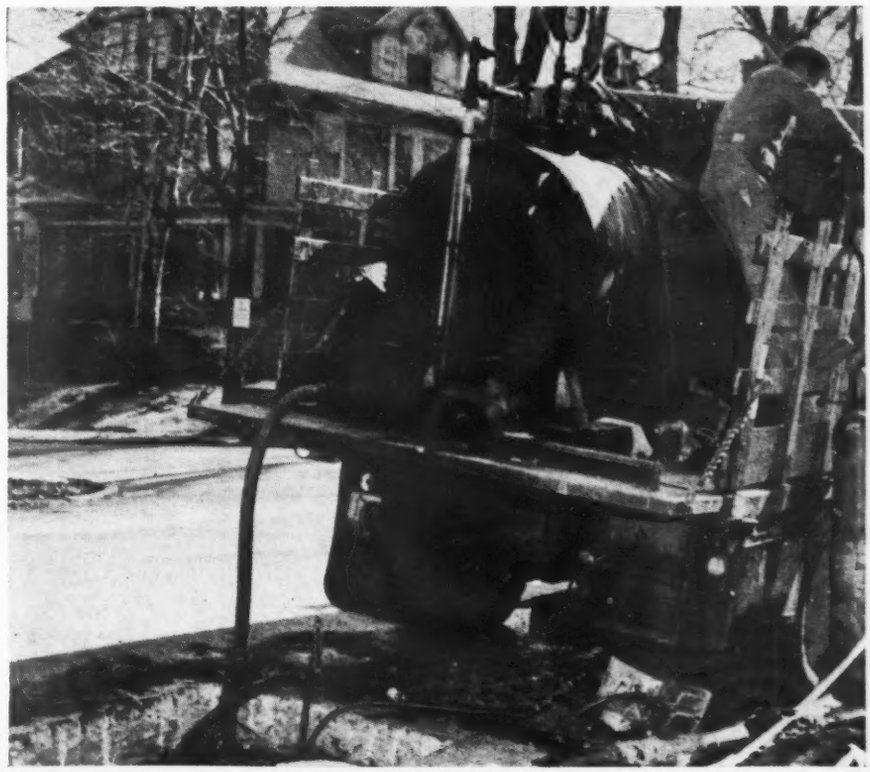


Fig. 2. 2000-gal tank truck used for filling and draining main. Truck is equipped with Moyno progressive displacement pump capable of pumping 83 gal per min.

Fig. 3. 300-gal tank mounted on truck is used to pressurize main after it is filled.



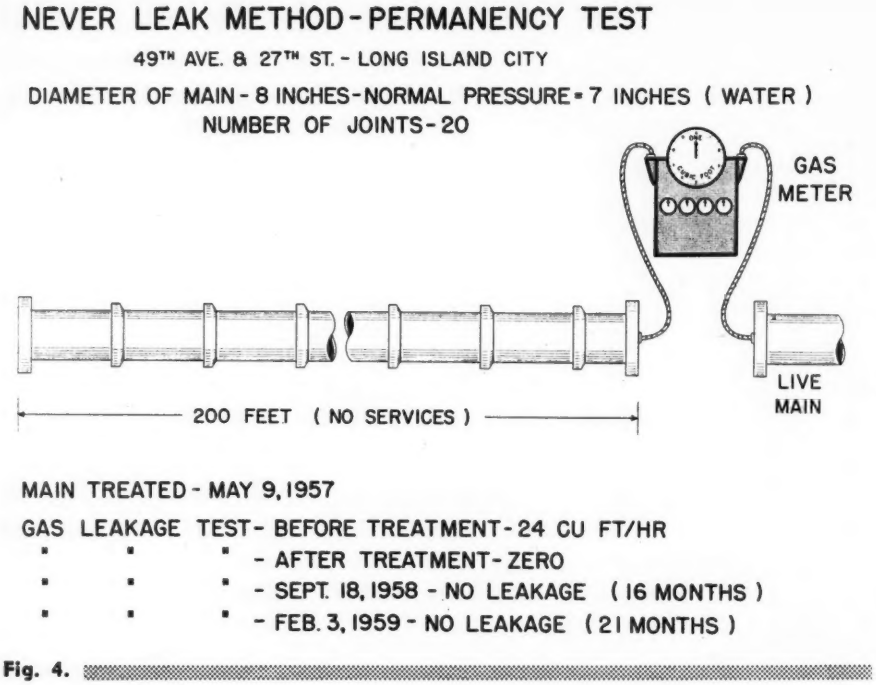

NEVER LEAK METHOD - PERMANENCY TEST
49TH AVE. & 27TH ST. - LONG ISLAND CITY
DIAMETER OF MAIN - 8 INCHES - NORMAL PRESSURE - 7 INCHES (WATER)
NUMBER OF JOINTS - 20
GAS METER
LIVE MAIN
200 FEET (NO SERVICES)
MAIN TREATED - MAY 9, 1957
GAS LEAKAGE TEST - BEFORE TREATMENT - 24 CU FT/HR
- AFTER TREATMENT - ZERO
- SEPT. 18, 1958 - NO LEAKAGE (16 MONTHS)
- FEB. 3, 1959 - NO LEAKAGE (21 MONTHS)

Fig. 4.

sure gages and liquid flow gages, we can tell a lot about what is happening. Loss of liquid pressure can be caused by one of two things:

a. Any small pockets of air at joints are compressed to a pressure equal to the liquid pressure (maximum of 65 psig) and gradually driven out of the joints, thus leaving gaps that must be filled by the addition of liquid in the main;

b. Some liquid is lost by penetration of the joints until the filtration process has advanced far enough to accomplish a seal that will prevent further loss of liquid.

A point is finally reached when liquid pressure remains constant; this is an excellent indication that the pipe is completely filled with liquid. When this stage is reached, further addition of a small quantity of liquid will cause a sudden increase in pressure.

Leaky Threads Also Sealed

It has been found by experience that leaky threads on service connections to the main or on threaded plugs on the main are effectively sealed by this same method. Apparently, the "filtering" of the solids is also effectively accomplished in the case of threaded joints. A 2-in. steel main assembled with threaded joints that were leaking has been successfully sealed by this method.

Holes in service pipes, cracked mains, etc., are not effectively sealed by this method. They are discovered during the filling operation, and must be repaired before completing the sealing operation.

While this sealing method may appear to be relatively simple, it should be realized that it requires effective supervision and attention to details on the part of the man in charge of the operation.

A very lengthy discussion would be needed to incorporate all operating details and the handling of the various operating problems that may be experienced during the operation. It suffices to say that a competent foreman is needed on the job. As experienced is gained, all problems encountered during the operation are handled successfully, as has been demonstrated in our area.

Equipment Used

A 2000-gal tank truck (Fig. 2) is used to transport the sealing liquid. The truck is equipped with a Moyno pump for filling and draining the gas main. A supplementary 300-gal tank on a separate truck (Fig. 3) is then connected to the main to pressurize the liquid. This tank is equipped with a glass gage for observing the flow of small amounts of fluid into the gas main. Pressure is applied and maintained by the use of cylinders of CO_2 gas.

On the Con Ed gas system, it has not been necessary to clean any of the gas mains before the application of the liquid. It has been found, however, that as liquid is drained, a considerable amount of dried gum or other debris will come out with the liquid, and by using a filter in the hose connection, all the liquid is restored to usable condition.

Experience

Results of our work on 143,307 ft of

Table A.
Summary of Gas Mains Treated by the Never-Leak Method.

Pipe ID Inches	Total No. of Ft Treated
2	720*
3	5,881
4	77,991
6	45,755
8	7,527
10	390
12	4,933
16	110
Grand Total	143,307

*Steel and wrought iron.

Table B.
Typical Low-Pressure Cast Iron Gas Mains Treated by Never-Leak Method.
(Low Pressure: 4 to 8-in. Water Column)

Pipe ID Inches	Length of Main Treated—Ft	Leakage—Cu Ft Per Hr	
		Before	After
4	849	15	0
4	1290	39	0
4	1370	72	0
6	600	19	0
6	1200	69	0
6	1410	63	0
8	620	50	0

A section of 2-in. steel pipe with threaded joints and services was treated by the never-leak method, and the leakage through the threads was stopped.

main successfully sealed by this method are summarized in Table A below. This represents 14,000 joints sealed by this method and with the performance indicated in Tables B and C. Typical jobs on both low and medium pressure mains are also illustrated in Tables B and C.

It should be realized, however, that when a medium pressure main is treated by this method, we cannot immediately restore medium pressure gas. For a period of approximately 6 to 8 weeks, the pressure in the area is reduced to approximately 20-in. w.c. pressure; this allows sufficient time for the moisture in the liquid to evaporate and provide a solid seal before the line is subjected to several pounds pressure.

Had we applied the higher pressure immediately, the wet material in a number of joints might not resist the pressure and, therefore, a path of leakage might be established. In one job it has been possible to seal 4880 ft of main all in one operation by using two 2000-gal supply tank trucks.

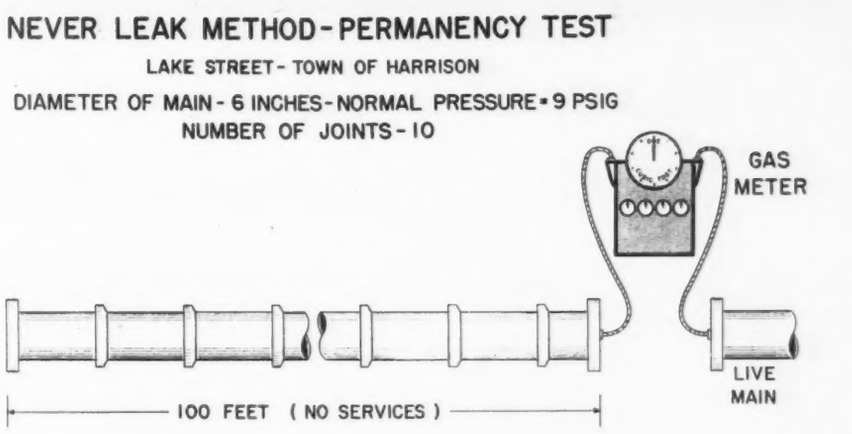

NEVER LEAK METHOD - PERMANENCY TEST
LAKE STREET - TOWN OF HARRISON
DIAMETER OF MAIN - 6 INCHES - NORMAL PRESSURE - 9 PSIG
NUMBER OF JOINTS - 10
GAS METER
LIVE MAIN
100 FEET (NO SERVICES)
MAIN TREATED - JUNE 9, 1958
GAS LEAKAGE TEST - BEFORE TREATMENT - 1.6 CU FT/HR AT 20" PRESSURE
" " " - AFTER TREATMENT - ZERO AT 20" W.C. PRESSURE
(DRYING AND CURING PERIOD AT 20" W.C. PRESSURE FROM 6/9/58 TO 9/8/58)
" " " - SEPT. 8, 1958 - ZERO AT 9 PSIG
" " " - FEB. 2, 1959 - ZERO AT 9 PSIG

Fig. 5.

Effectiveness of Sealing Operation

In adopting an operation of this type, one naturally wishes to have some assurance of the permanence of the sealing operation. While we have already established the fact that every job has been reduced to zero leakage at the end of the sealing operation, it is important to know what can be expected to happen in the future. The answer to this question has been sought:

Chemical tests were made to determine whether natural gas, its components and odorizer have any deteriorating effect on the cured material that forms the seal in the joint. The results of these tests were completely reassuring. Mechanically speaking, because of the resilience of the seal it will withstand the effects of vibration or other movement. It will protect the jute from further deterioration from the effects of gas.

To obtain some practical experience on the subject of permanence, we have taken two locations, (Fig. 4 and 5) one for low pressure and one for medium pressure, where we have dead-end mains without services, sealed them by this method, and then installed meters in manholes built for the purpose in the connection between these dead-end mains and the rest of the system in order to register the loss of gas, if any, on sealed mains. To date both of these installations, one approximately two years old and one approximately one year old have revealed absolutely no loss of gas. These measurements will, of course, be continued in the future.

Conclusion

Areas sealed by this method have been surveyed by infra-red leak detection equipment, and the results obtained are tabulated in Table D. The results are gratifying.

Acknowledgment

This article prepared from a presentation made at the 1959 A.G.A. Distribution Conference, Cincinnati, Ohio.

* * *

Table C.
Typical Medium Pressure Cast Iron Gas Mains Treated by Never-Leak Method.
(Medium Pressure: 2 to 15 psi)

Pipe ID Inches	Length of Main Treated—Ft	Leakage—Cu Ft Per Hr	
		Before	After
4	842	68	0
4	1472	61	0
4	1689	67	0
6	813	73	0
6	1410	63	0
6	1150	236	0
4 & 6	4880	390	0

Table D.
Summary of Infra-Red Detection Program to Determine Leakage of Sections Treated by Never-Leak Method.

155 Sections of Gas Main Treated = 143,307 Ft

120 Sections—No Leaks Reported
35 Sections—Leaks Reported

Investigation of the 35 Sections Showed 30 Leaks

No. of Leaks	Description of Leaks
3*	Joint leaking.
9	Packing leaking on main valves and leaking curb valves.
2	Leaking 2-in. services.
10	No indication of natural gas.
6	Still under investigation.

*The three joints found leaking were all in the same section treated.

How To Increase Capacity Of Existing Systems

Highlight of the *Distribution Design and Development Session* of the A.G.A. Distribution Conference in Cincinnati was a panel discussion on ways and means of increasing capacity of existing distribution systems. Experiences of the four companies represented on the panel are presented in the following 11-page report. Members of the panel, above, left to right, are **E. F. Trunk,** Laclede Gas Company, St. Louis, Missouri; **R. J. Maccardini,** (substituting for P. B. Thompson), Michigan Consolidated Gas Company, Detroit, Michigan; **M. L. Bock,** Consumers Power Company, Jackson, Michigan; **H. C. Missimer, Jr.,** (moderator), Philadelphia Gas Works, Division of U. G. I., Philadelphia.

IN PHILADELPHIA . . .

Three-Phase Program on Three-Pressure System Uses Time-Temperature Loaders, Telemetering

H. C. Missimer,
Assistant Superintendent,
Gas Distribution Department
Philadelphia Gas Works, Division of U.G.I.
Philadelphia, Pennsylvania

IN PHILADELPHIA, increases in system capacity have been accomplished in a three-phase program:

1. Increasing the high-pressure system capacity by the omission of service regulators on large industrial customers.
2. Increasing the medium pressure system capacity by elimination of step-down regulator between the high and medium-pressure systems.
3. Increasing the low-pressure system capacity by means of loading regulators.

Before explaining details of these three phases of increasing system capacity, it is necessary to explain our system in order to give you a better idea of what is to follow. The Philadelphia Gas Works operates the gas system within the city limits of Philadelphia and mains cannot be extended outside of the city limits. Philadelphia covers 129 square miles and contains some 560,000 gas customers, who are supplied by some 2600 miles of mains. The 750 Btu mixed gas is distributed over a system using three pressure levels. There is a **high-pressure system** that has a maximum operating pressure of 30 psi; a **medium-pressure system** that operates at a maximum pressure of 6 psi, and a **low-pressure system** that operates between 4½ and 8½-in. w.c.

Fig. 1 shows how Philadelphia is shaped like a Big "Y." Production and pumping stations are located on the leg and on the arm of the Y. The medium-pressure system is located on the ends of the arms and the bottom leg of the Y. The low-pressure system lies between the medium-pressure system. The high-pressure system feeds both the medium and low-pressure system.

Increasing High-Pressure System Capacity

Recently a new wholesale seasonal rate was established for large industrial customers who could be supplied from the high-pressure system during off peak periods. These industrial customers desired a minimum of 8 psi pressure delivered to the outlet of the meter instead of the 2 psi that was guaranteed in the past. Consideration was given to how the total pressure drop from pumping station to customer appliance could be kept to a minimum. Service regulators had always been installed on lines serving large industrial customers and supplied from the high-pressure system. These customers also used regulators to control pressure to their equipment.

After studying both present and proposed codes, it was decided that our regulators could safely be eliminated and thus save the pressure loss across the regulator. It was also decided not to use a permanent filter on strainer in order to prevent additional pressure drops. In these two ways the pressure capacity of the high-pressure system is being increased.

Increasing Medium-Pressure System Capacity

The medium-pressure system has grown on the ends of the arms and leg of the Y to keep pace with the growth of the city. Growth came to these areas late and it is now taxing the capacity of the existing system because the gas has to travel the greatest distance to get to it.

A regulator exists wherever gas is delivered from the high-pressure sys-

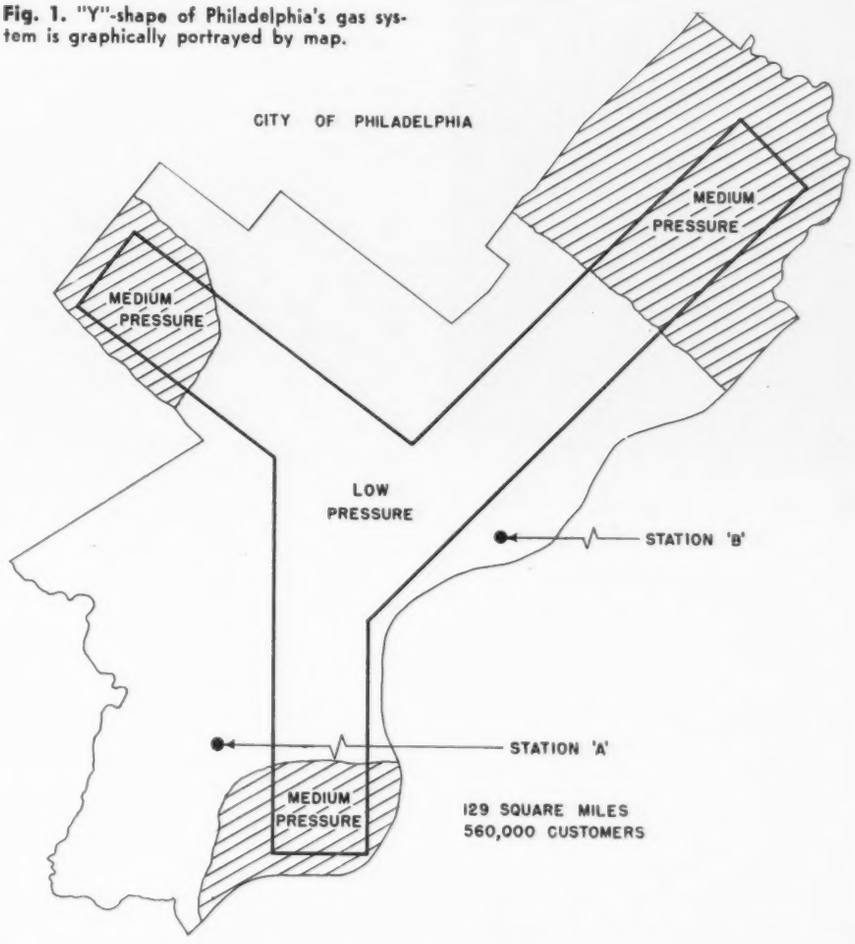
tem to the medium-pressure system. Each of these regulators causes a pressure drop. This pressure drop, being taken across the regulator, represents a loss of pumping capacity. If this pressure drop is eliminated, it helps increase the pumping on system capacity.

Pressure difference between the high-pressure and the medium-pressure system is not great. During the winter the medium-pressure system may operate between 4 to 6 psi, while the maximum pressure on the high-pressure system at these points may be from 10 to 15 psi. This is, at best, a difference of 11 psi.

All customers within the medium-pressure system are protected with service regulators and, with a small expenditure, these installations could be made to comply with the B31 code under the higher pressure. The thought, then, is *why not open up the street regulators leading into the medium-pressure system on cold days or possibly do away with them altogether?*

A study is underway in the most critical area to determine what cost would be incurred to alter the house regulator installations to comply with the code and what would be the effect of higher pressures on the medium-pressure distribution main system. A test was made in January and the results look favorable. If experience in this area proves successful, it may be tried on the other medium-pressure areas. If this study proves effective, it

Fig. 1. "Y"-shape of Philadelphia's gas system is graphically portrayed by map.



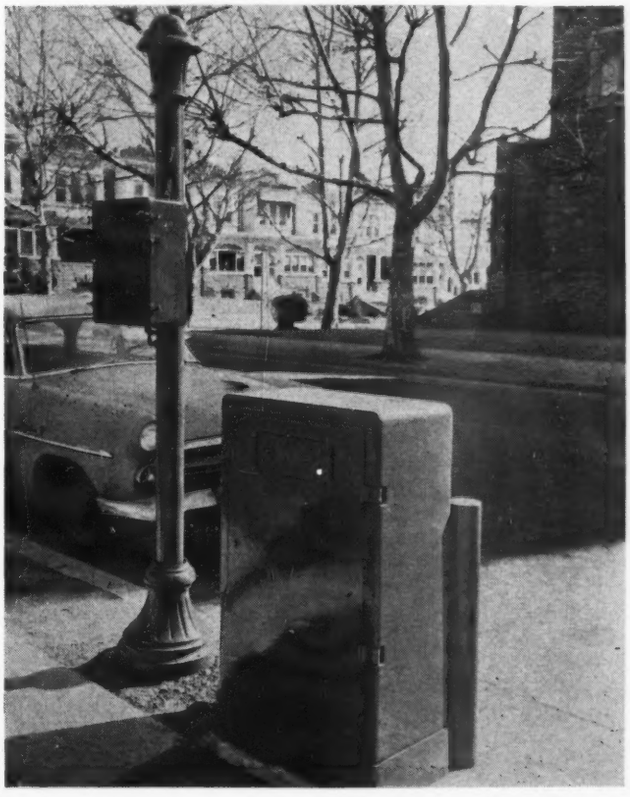


Fig. 2. Time-temperature loaders are housed in outside traffic control box adjacent to regulator pit.

Fig. 3. With control box door open, arrangement of installation can be seen. Time-temperature device is in center and upper left.

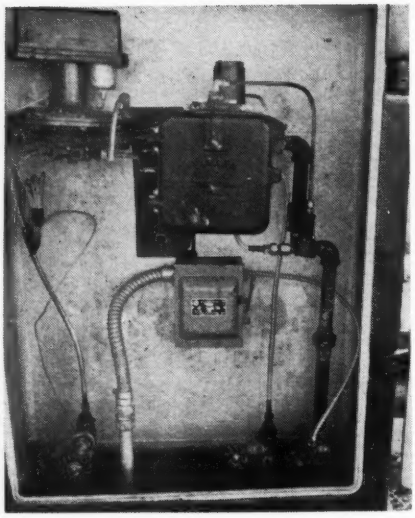


Fig. 4. Close up view of box housing electric clock.

will help increase the system capacity and forestall the need for investing capital dollars in new pumping equipment and mains.

Increasing Low-Pressure System Capacity

In the past it was thought that the best operation was to have even pressure over the entire city throughout the year; to vary this pressure was not considered good distribution practice. In some instances, however, pressures were varied at certain street regulators and holder stations to hold 5-in. w.c. at a given point.

Various types of loaders were tried over a period, but only in two instances did they prove successful.

As years went by, it was felt that the increasing househeating loads could not be served economically by maintaining this "even" pressure over the city all year long. Househeating saturation 10 years ago was 8 percent; today, it is 35 percent and, in 15 years, it is expected to go to 64 percent.

A committee consisting of representatives of the customer service, distribution, and engineering departments was formed to determine the safe efficient operating pressure range for satisfactory appliance operation. To do this, two areas that were served mainly by one regulator each, were selected for a test to determine what effect increased pressure had on the appliance operation. The pressures were increased on a relatively cold day, beginning about 4 p.m., just prior to the evening load. Starting with a base pressure of 5-in. w.c., the outlet pressure of the regulator was increased ½-in. every half hour.

During these various steps of increasing pressure, customer service technicians visited homes in the area. They observed the burning characteristics of the customers' appliances and, from these observations, the following pressure ranges were determined and given to the engineering department for designing the low-pressure distribution system.

The design criteria are:

1. Where automatic loading of regulators is used, the pressure variation over the area may vary from a minimum of 4½-in. to a maximum of 8½-in. w.c. on the peak hour flow on the design day.
2. Where non-automatic regulators are used and manual loading is intended, pressure variation over the area may vary from a minimum of 4½-in. to a maximum of 7½-in. w.c. for a 24-hour period on a design day.
3. Where non-automatic regulators are used and loading is not attempted, the pressure variation for the full winter period should be from a minimum of 4½-in. to a maximum of 6½-in. w.c.

From this study the 5-in. w.c. base pressure that was used for many years was raised to 5½-in. w.c. from March to early November and to 6½-in. w.c. from November through February.

Now that pressure could be raised on the outlet of regulators to 8½-in. w.c. on the peak hour, the problem was to find a loader that would give both good pressure and good operation throughout the year and would comply with the new established criteria.

Tests were made during the past winter with two time-temperature loaders and two telemetric type loaders.

Time-Temperature Loader Installations

Fig. 2 shows how the time-temperature loaders were housed in an outside traffic control box adjacent to the regulator pit. Note that the traffic signal control box provides a neat appearance for the equipment housing.

Fig. 3 shows the same installation with the door of the control box open. The time-temperature device is in the center and in the upper left hand corner of the box. These installations were made aboveground to make experimenting with them easier. We also wanted to use an electric clock on one as spring-wound clocks have been a source of trouble and we didn't care to have electricity in an underground pit.

Fig. 4 shows a close-up view of the box housing the electric clock. Regulator control piping is shown coming from the lower right hand corner of the traffic control box, where it is connected to the time-temperature loader, and then back to the underground pit. The coil of what appears to be wire on the left hand side of the box is the tubing that runs to the temperature bulb housed in the vent post.

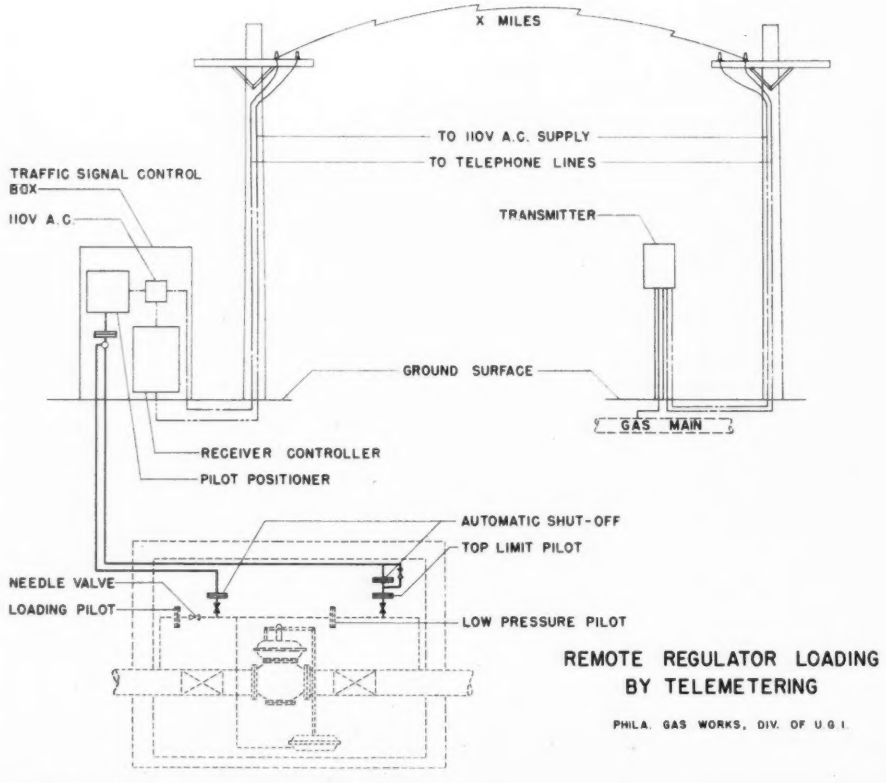


Fig. 5. Diagram of automatic telemetric loading system.

Two Types Used

Two different types of automatic telemetric loaders were used in the experiments. We will refer to them as the *on-and-off type* and the *slide-wire type*.

The *on-and-off* type operates similar to a househeating thermostat; i.e., your heater is either *on* or *off*. The *slide-wire* or *Wheatstone bridge type* operates similar to a temperature control on an industrial furnace — where the controlling unit is always operating.

Fig. 5 shows a sketch of the total installation. This includes the transmitter, receiver, traffic control box, and underground regulator pit. As with the time-temperature loaders, the loading devices are installed aboveground in the traffic control box.

Several precautions were taken in case the control box was damaged for one reason or another. Automatic shut-off pilots are installed inside the regulator pit. These pilots will shut off the control lines coming from the underground regulator pit to the control box. If these shut-off pilots are not installed, and the control box is damaged, the regulator could either fail open or close, depending upon the circumstances.

Fig. 6 shows the pole mounted transmitter. It is installed adjacent to the street curb and connected to the main where the lowest peak day pressure occurs for the area involved. The transmitter sends its signal over telephone lines to the traffic control box housing the telemeter receiver.

Fig. 7 shows the installation of the *slide-wire type*. The box with the dial hand houses the telemeter receiver and the slide-wire device. In turn, it transmits a signal to the motor in the upper left hand corner, which operates the loading pilot directly under it.

Fig. 8 shows the *on-and-off type*. This installation is similar to the slide-wire type. The box housing the recording gage contains the telemeter receiver, which causes the motor in the upper left hand corner to operate in one direction or the other. This, in turn, operates the loading pilot directly under it.

In our first year's experience, the *on-and off type* has given the best results under the rules established for our design criteria. It automatically gives the amount of pressure required when and where it is needed.

Four areas had to be found where loaders could operate in the integrated system without affecting adjacent regulator operation. Experiments were made to determine what effect raising the outlet pressure of certain district regulators would have on adjacent areas. These experiments were made on a cold winter's day over the peak hour. Gages were placed in the test areas and in areas adjacent to it. Pressures were increased from 6½ to 8½-in. w.c. on the outlet of the regulator or regulators feeding the area in question. Pressures were observed in the area, and on adjacent regulators to determine the effect.

If the adjacent regulators were not backed off at the same time, the pressure at the test point was increased, and there was no doubt that a loader could work satisfactorily. By this means we located four district regulators that

Fig. 6. Pole-mounted transmitter relays pressure reading from system's peak day "low point" for area involved.

appeared promising for use of the test equipment.

During the 1958-59 winter, two other areas were discovered where loaders could work. Installing loaders at these points will save the immediate expenditure of several thousands of dollars on main reinforcements for certain particular areas. From our experience, I feel that loaders will work at certain prescribed areas in an integrated system. As the househeating concentration grows, however, main work may eventually be required.

Economics must be considered. In a certain area of our system, it will cost approximately $55,000 to install

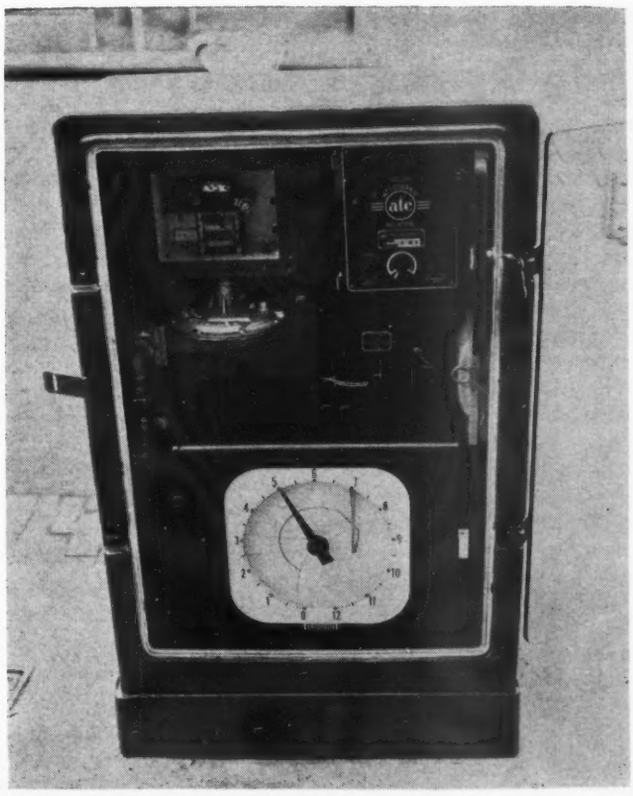


Fig. 7. Slide-wire type telemetric unit installation.

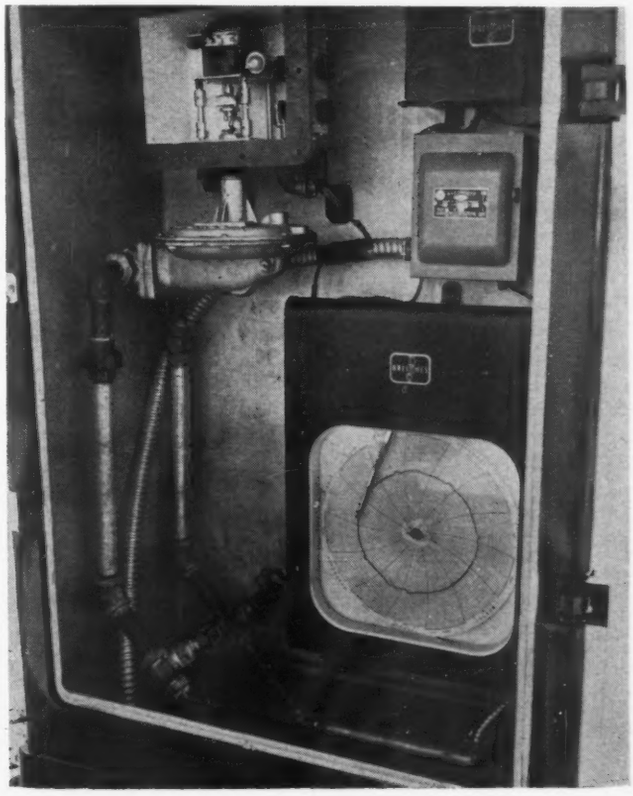


Fig. 8. On-and-off type telemetric unit installation.

mains and regulators to care for the anticipated growth. A loader can be installed for about $1500. The figure takes in account the recoverable equipment that can be used at another location. If the loader can forestall capital expenditures for one year, it has more than paid for itself, considering that the interest on $55,000 at 6 percent is $3300.

In 1957 we queried 17 companies about their experiences with loading type devices. We found that 3 had no experience, 7 had unsatisfactory experience, 3 had questionable experience, and only 4 reported favorable experience. It is apparent from these 17 companies replies that loading of regulators has not been considered too satisfactory. I feel, however, that there is a place for loaders in certain definite areas under certain prescribed conditions. If loaders are used properly, they can help increase system capacity.

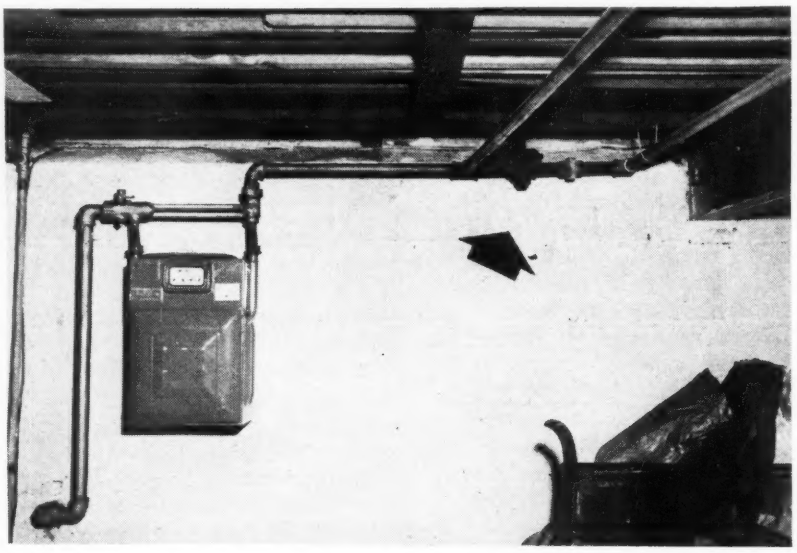


Fig. 1. Arrow points to ¾-in. single-port, weight-loaded appliance regulator installed between meter and customer's appliances.

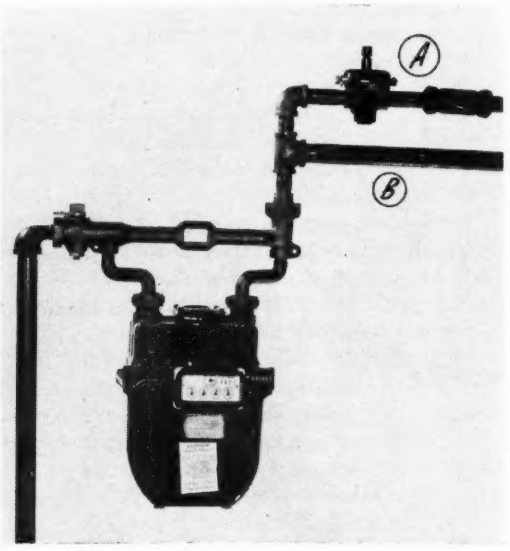


Fig. 2. Where customer has spaceheating unit (which is equipped with its own appliance regulator), this type installation is used; appliance regulator is installed on line supplying other appliances (A) and direct line (B) is run to space heating equipment.

AT CONSUMERS POWER . . .

Appliance Regulators, Remote Control, and Time-Cycle Pressure-Boosting Increase Capacity

Melvin L. Bock, *Gas Engineer,*
Consumers Power Corporation
Jackson, Michigan

WITH ever increasing material and labor costs for main replacements, Consumers Power Company found it imperative to search for ways of increasing existing system capacity to adequately serve its customers and enable it to avoid and delay costly main replacements.

We have in operation, and with considerable success, three methods of increasing system capacity. They are:

Application regulation,
Remote control, and
Time cycle pressure boosting.

Appliance Regulation

Several plans were considered to augment the capacity of our standard pressure cast-iron distribution mains to meet the increasing space heating, commercial, and industrial loads. These included replacing small mains with larger sizes, adding large feeder mains to the system, and converting the existing standard pressure (or inches water column) system to a medium (or pounds) pressure system. The medium-pressure system would require house regulation at the end of each service immediately.

All of these methods were considered too costly because of congestion of the areas involved, as most of our standard-pressure mains are in older commercial sections of the cities. It would also result in an increase in unaccounted-for gas and an increase in inspection, maintenance, and operating costs.

To meet this problem, company engineers developed and augmented our appliance regulation program.

This program allowed us to increase our distribution pressures during peak load periods from 4 to 6-in. w.c. to 10 to 14-in. w.c. to increase our supply.

To accomplish this program, a ¾-in. single-port weight-loaded appliance regulator (Fig. 1 and 2) was installed between our meter and all of the customers' appliances, except the space heating unit. The space heating unit is equipped with its own appliance regulator on our system.

In selecting the desired appliance regulator, we took into consideration the following factors:

1. To assure us that all the necessary maintenance and adjustments of appliances were performed, it was necessary to secure an appliance regulator with a fixed outlet pressure. This restricted the possibility of increasing the pressure setting of the regulator rather than performing the necessary work on the appliances. For this reason a weight loaded regulator was selected.

At the present time we are investigating a spring-loaded appliance regulator that has a maximum spring

Fig. 3. Remote control of district regulator station pressure settings is centralized at control headquarters in each gas division.

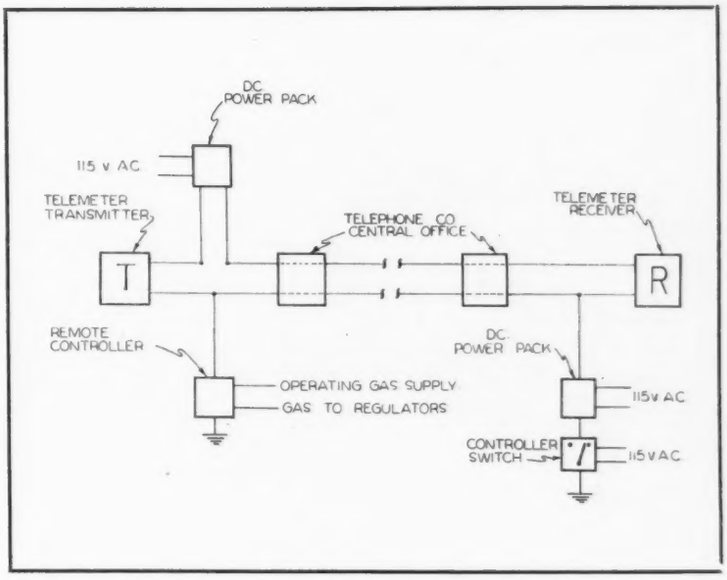


Fig. 4. Telemetering and remote control telephone circuit.

adjustment from the set point of 1-in. w.c.

2. Secure a regulator that would not close off until the pressure increased above 15 to 20-in. w.c., but would close before excessive pressures reached the connected appliance.

3. Secure a single appliance regulator that was economical and capable of supplying normal residential and commercial loads, excluding the space heating unit.

After the appliance regulator was selected, the program was inaugurated by cutting these appliance regulators into the customers' fuel lines after the meter. In order to avoid installing vent lines, a leak limiting device was installed in the regulator vent. This limited the flow of gas into the surrounding area to 1 cu ft per hr in the event of diaphragm failure of the appliance regulator.

This type of program can be done in stages by starting at the standard-pressure district regulator stations and fanning out as the pressure requirements increase.

We feel there are a number of advantages to this appliance regulator program:

1. Increase of existing system capacity during peak periods by approximately 75 percent.

2. Pressures are available for increased pressure loss in mains and services without affecting appliance performance.

3. Pressures are elevated only during peak load periods.

4. One unit can be installed at the cost of laying two feet of 6-in. main.

5. Service calls decrease.

6. Pilot outages are reduced.

7. Gives very good regulation at all appliances.

8. Dust stoppages are fewer because of larger orifice openings consistent with lower pressures of 4 to 4½-in. w.c.

9. Appliance regulators will close on excessive high inlet pressure.

Disadvantage to this system is that the gas is metered at slightly higher pressures than the 4-in. w.c. utilization pressure. This gives the customer the advantage of the pressure correction factor on the volume of gas metered. It is relatively small compared to the costs of maintenance and operation of other types of systems, since the correction factor is only 1 percent for each 4-in. w.c. increase in pressure. We feel it is better to give the customer the benefit of this increased meter pressure rather than lose it on the operation of another type system.

Remote Control

We use the remote control method to change the pressure settings of district regulator stations as conditions and demands dictate, operating from

Fig. 5. Remote controller and telemetering transmitter are housed outside the regulator station; this eliminates costly explosion-proof electrical instruments.

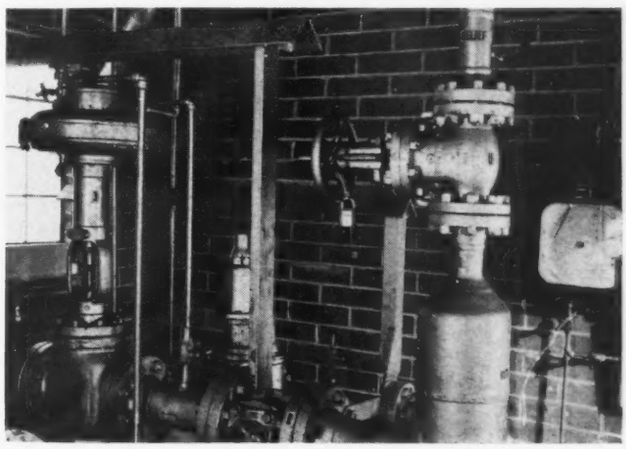


Fig. 6. Instrument loaded regulator installation.

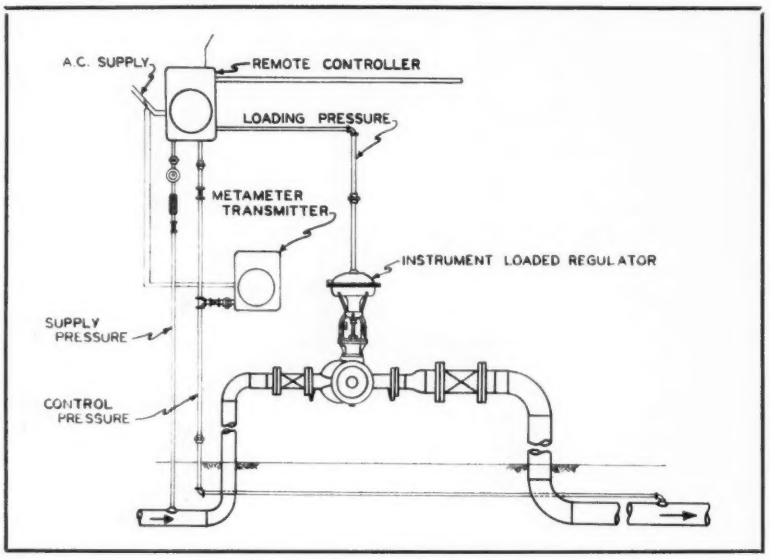


Fig. 7. Diagram illustrates remote control-telemetering set-up.

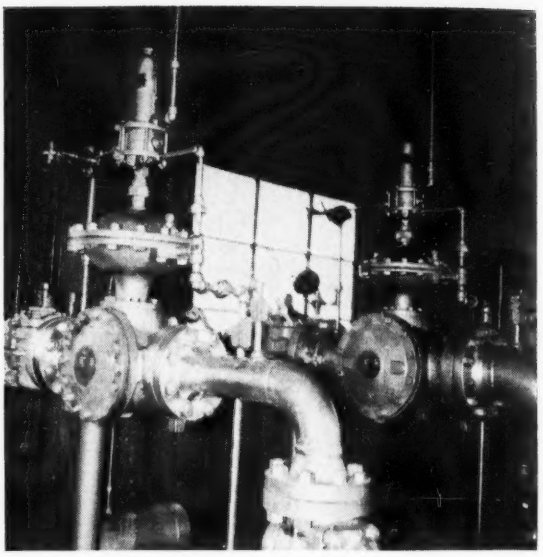


Fig. 8. Pilot loaded regulator installation.

a centralized control headquarters in each of our gas divisions (Fig. 3). We use this technique in conjunction with telemetering so that the station operator may observe the continuous operation at our major stations.

We accomplish this remote control and telemetering by transmitting a direct current signal over a full metallic pair of leased telephone wires (Fig. 4). In considering the physical installation of our telemetering and remote control equipment, we connect our telemetering transmitter and recording receiver in a parallel or loop system and our remote controller and positioning switch in a series or grounded system of one of the telemetering loop lines.

Because the telemetering portion of the system is transmitting a d-c signal 24 hours per day, it is not desirable to operate it on a single wire or grounded system. It is also one source of stray currents (causing corrosion of our mains) that can be easily eliminated by the use of the parallel wire system.

In contrast, the remote control part of the system is used only several minutes each day, therefore, it is connected on a grounded system of one of the loop lines. When in operation, it shorts out the telemetering signal temporarily. We feel this can be justified because it permits another leased telephone line to be eliminated at a considerable saving each year.

At the regulator station end of this system, the electrical equipment — such as the remote controller and telemetering transmitter — are housed in facilities outside the regulator station proper. This eliminates the cost and necessity of using explosion-proof electrical instruments (Fig.5).

On installations where an instrument loaded regulator or motor valve is present (Fig. 6 and 7), the remote controller will maintain a constant outlet pressure on the regulator. If it is desired to change this setting from the centralized control station, this is done by energizing the telephone circuit with d-c current. Polarity of the current or position of the switch determines whether the outlet pressure of the controlled regulator is increased or decreased.

If the existing regulators in the station are pilot loaded, and it is not desired to purchase a motor valve reg-

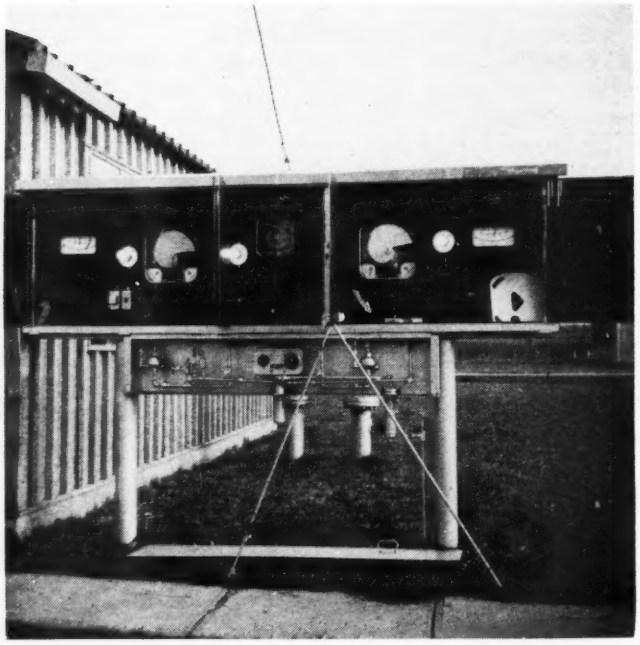


Fig. 9. By using a time cycle intermitter (center of cabinet), signals can be transmitted from two transmitters and two remote controllers, reducing cost of leased wires by 50 percent.

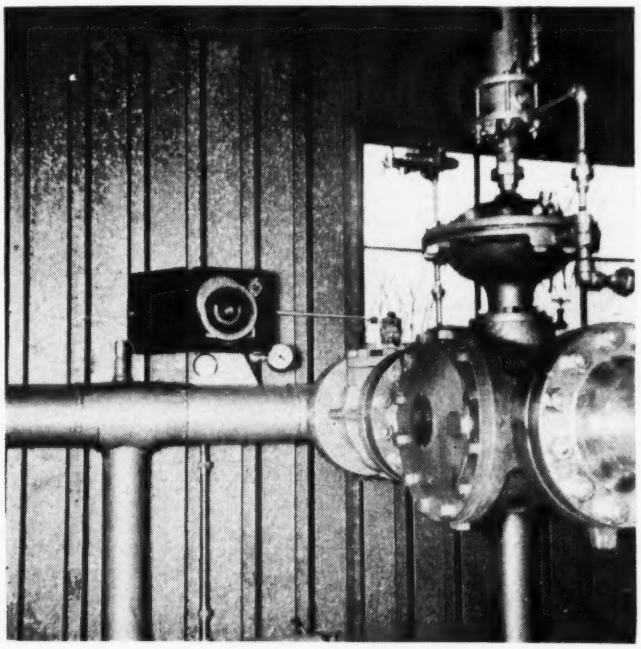


Fig. 10. Time cycle intermitter or clock arrangement can be used for automatic pressure boosting.

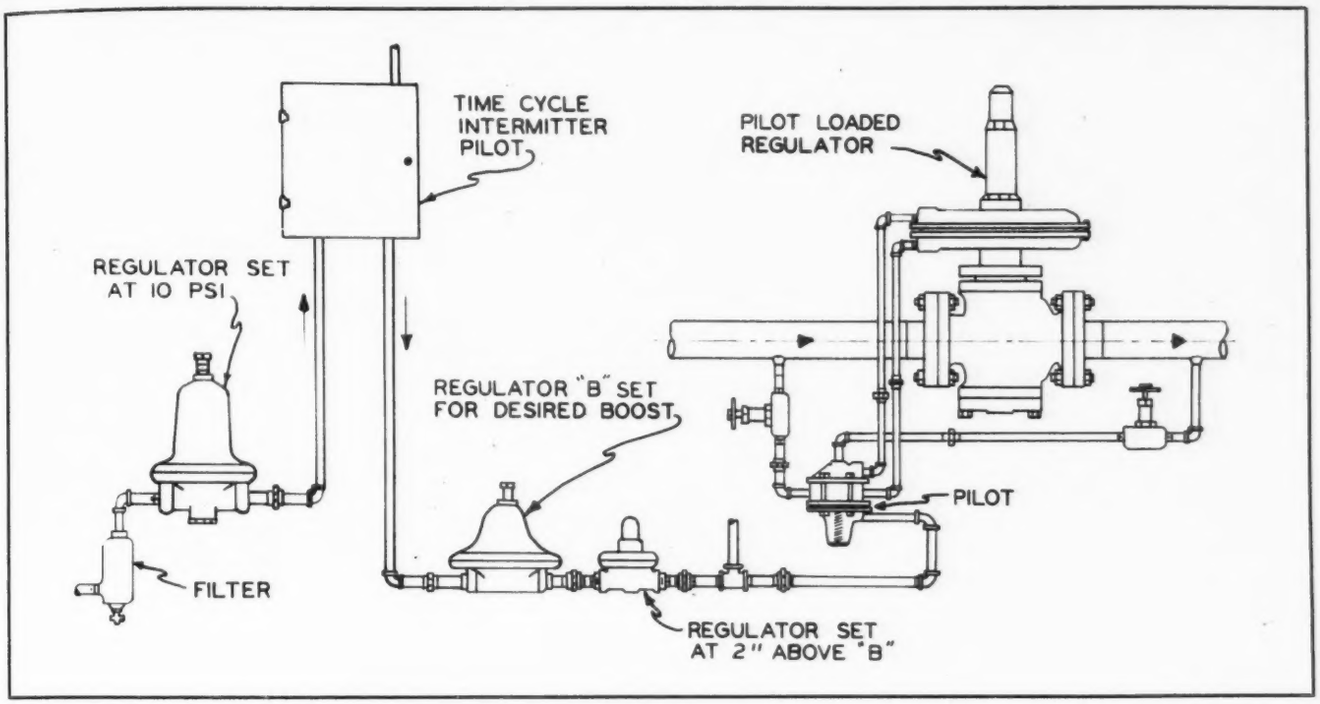


Fig. 11. Diagram shows how time cycle intermitter is used.

ulator, it is possible to use the remote controller as a remote positioner of the set pressure by loading the vent side of the pilot (Fig. 8). This will add to the spring setting of the pilot, giving an increase in pressure setting of 3 to 15 psig, depending upon the position of the remote controller cam.

A number of variations can be used from the system described above, such as incorporating pneumatic relays (Fig. 9) to give higher loading pressures than the range of the remote control instrument. It is also possible to transmit signals intermittently across a single pair of wires, as previously described, from two transmitters and two remote controllers through a time cycle intermitter. This will reduce the cost of the leased wires by 50 percent.

The remote control and telemetering method of increasing system capacity is very advantageous in that the regulator stations can be controlled remotely at any time to balance the stations as the loads change.

Time Cycle Pressure Boosting

Another technique used for increasing system capacity is automatic pressure boosting through the use of a time cycle intermitter or clock arrangement (Fig. 10 and 11).

The time cycle intermitter is a clock controlled, three-way valve that, at a preset time (high load period), will allow gas to flow through the boosting regulator to the pilot of the main regulator. This added pressure on the pilot causes the loading pressure of the main regulator to be increased, thus opening the main regulator valves wider and boosting the pressure in the gas main.

At a preset time (low load period), the time cycle intermitter pilot will then shut off the gas to the boosting regulator. At the same time it will open the vent, allowing the gas pressure to the boosting regulator to bleed to the atmosphere, shutting off the boosting regulator. The gas between the boosting regulator and the pilot will then vent through an orifice to the atmosphere, which will return the main regulator back to its normal operation.

This type of installation provides a very economical means of boosting regulator station outlet pressures during maximum load periods to increase the capacity of the distribution system.

There are other means of increasing system capacity, however, appliance regulation, remote control and time cycle pressure boosting has proved advantageous to our operations.

IN DETROIT . . .

. Service Regulators, Elevated Pressures Help Mich-Con Meet Vast Expansion Needs

P. B. Thompson,
Assistant Engineer of Distribution Design
Michigan Consolidated Gas Company
Detroit, Michigan

TO BEGIN this story one must realize that Michigan Consolidated had had some sort of spaceheating restrictions imposed on it from November 1942, until August 1949. Lifting of these restrictions in 1949 came with the completion of the Michigan-Wisconsin pipeline from the Southwest.

The anticipated large increase in the househeating load due to the removal of restrictions in August 1949, presented a problem of supply to customers that were supplied by our low-pressure distribution system. Based on our preliminary estimates at that time, it was anticipated that approxi-

mately 50,000 heating installations would be connected during 1950 and many thousands more in subsequent years. At that time approximately 80 percent of our domestic customers were supplied by a low-pressure distribution system consisting of 12-in. and/or 8-in. headers and 4-in. laterals operating at an average pressure of 6-in. w.c.

Calculations of the effect of this increased load indicated that the capacity in at least the major portion of the existing low-pressure distribution system would be entirely inadequate. In fact, certain areas in the low-pressure distribution system would require an increase in capacity immediately. Consequently, plans for improving the supply to the customers were studied.

The two plans considered for increasing the supply of gas in the areas of heavy sendouts were:

PLAN I. Reinforcement of the areas of heavy concentration by laying additional header and lateral mains while continuing to supply the gas at an average pressure of 6-in. w.c.

The cost of reinforcing the existing low-pressure distribution system was found to be excessive because — in many areas — practically a duplication of the entire system would be required. It would probably be necessary to parallel many of the lateral mains to reduce excessive pressure drops caused by the heavy househeating loads. It was apparent that:

1. Costs of such a program would be prohibitive.
2. Material was not available in sufficient quantities to do all the work required.
3. Immediate reinforcement was necessary, but it would take years to do the work even if the obstacles mentioned above were overcome.

It was decided that such a program would be impossible to accomplish. It is neither logical nor economical to build a distribution system of large potential capacity and then restrict that capacity by limiting pressure drops to 2 or 4-in. w.c. The capacity of a system is, of course, a function of the allowable pressure drops. If pressure drops are excessive, variation of pressure at customers appliances creates a very undesirable condition. These two factors are diametrically opposed and the result is a compromise that, consequently, permits only a fraction of the relatively large capacity of the system to be realized.

PLAN II. Reinforcement of these areas by elevating distribution pressures to 1½ or 2 psig and installing service regulators.

Plan II provided for service regulators on all services and pressures of around 2 psig at the outlets of the district regulators feeding the area. This method would accomplish:

1. Eliminate pressure variation at the customers appliances.
2. Allow pressure drops of from 1 to 1½ psig in the distribution system, greatly increasing the capacity of the system.
3. Afford, by the addition of the house service regulators, additional protection to the customer against over-pressuring of their fuel line due to any malfunction of the district regulators.

Work could start immediately and be completed in time to handle the anticipated heating loads.

With the fundamental design of our system and the allowable pressure drops that would be available under this elevation plan, the capacity of the system would be such that we could handle a househeating saturation of 100 percent and still have gas available for large apartment houses and commercial loads. At that time it was decided to proceed with Plan II immediately.

Under Plan II it was necessary to divide the distribution system into areas to be elevated, convert the district regulators to deliver pounds pressure rather than inches, and install individual house regulators on every service in the areas to be elevated.

Preliminary Work

As all proposed househeating customers were required to file an application with the company before installing a heating unit, an accurate picture of the load distribution was available at all times. In addition, loads larger than 500 cu ft per hr received special handling to insure adequate supply in the same manner that new industrial customers were handled. All applications received by the company at the time were automatically accepted and spotted on maps. From this data, districts that were becoming overloaded could be outlined. Arrangements were then made to isolate these areas and to prepare them for elevated pressure.

Preliminary work required prior to elevating the low-pressure distribution system included preparing maps, outlining the areas to be elevated, determining the number of services in these areas, and determining the priority of elevation depending upon load concentration. It was felt that each area should not exceed approximately 25,000 services for ease of elevation.

Leak Survey Made

In conjunction with the pressure elevation program an extensive leak survey program was conducted at every service in the areas where pressures were increased. This survey indicated services that needed replacing and joints that needed clamping. As a result of this survey, all necessary maintenance was performed on the services and joints.

The entire pressure elevation program extended over a period of approximately seven years and is now completed. During that time, approximately 340,000 house service regulators were installed as a part of the program. In addition, another 68,000 service regulators were installed on new services being connected to our mains. From the start of the program to the present time, the number of househeating installations in the areas elevated has increased by approximately 250,000.

Peak Day Increase Near 5-Fold

Maximum day sendout since the start of the elevation program has increased from 207 MMcf in 1949 to 1011 MMcf in 1959 — approximately 500 percent. During the past winter, which was more severe than many in recent years, all of these areas had an adequate supply of gas.

In one rather typical square mile containing representative numbers of single residential homes, multiple dwelling homes, large apartment houses, and commercial establishments, the residential heating saturation has increased to 90 percent. The load during a maximum hour for this district was calculated to be between 450,000 and 500,000 cu ft per hr and was adequately supplied by the medium-pressure distribution system. Obviously, to supply such a load from a low-pressure system would be practically impossible — or, if not impossible, at least very expensive.

In the Detroit District areas where pressures have been elevated during the past 10 years, househeating saturation has increased from 13 percent to 63 percent; ultimate goal is somewhere around 85 percent. Design of the system — along with the operating pressure of 2 psig — should allow us to satisfactorily handle such a saturation.

Effect on System Maintenance

When considering this program, we knew it would also be necessary to study the effect of these pressures on main and service life. As expected, the number of service renewals increased over the normal replacement figure;

during the first year of the program, the increase was 100 percent. Other factors, however, over and above the pressure elevation program, brought about the increase in service renewals. These included a more effective leak survey program and the increasing age of the services.

As expected, the number of leaks on the cement and lead joints increased considerably while the mechanical joints were unaffected. It has been four years since the completion of the pressure elevation program, and it is felt that the initial impact on the bell and spigot joints has been felt.

District regulators feeding the original low-pressure distribution system were primarily of the weight loaded type. All of these regulators feeding into the elevated pressure areas have been converted to utilize the pilot loading principle and have required no more than normal periodic inspection. There has been no appreciable additional maintenance of these regulators attributable to pressure elevation.

IN ST. LOUIS . . .

Additional District Regulators and Temperature Boosters Prove Practical

E. F. Trunk, *Chief Engineer*
Laclede Gas Company
St. Louis, Missouri

JUST PRIOR to converting to natural gas in 1949, Laclede Gas went through a period during which the war-time restrictions on materials were removed. This made it possible to secure items such as gas furnaces and conversion burners. Gas supply was a problem until a second pipeline to the St. Louis area was completed by our supplier in 1949.

We had expected that a large number of customers would convert to gas heating, but we were not quite prepared for the deluge that followed. We had to call a temporary halt for several months to allow our forces to catch up with inspections, meter changes, and turn-ons so that all burners installed during the summer would be in operation when the heating season started.

In three successive winters our peak day went from 100 million cu ft to 190 million cu ft to 300 million cu ft per day. This kind of growth very quickly used up any reserve in the distribution system as well as the 25 percent increase that resulted from the change from 800 Btu mixed gas to 1000 Btu natural gas.

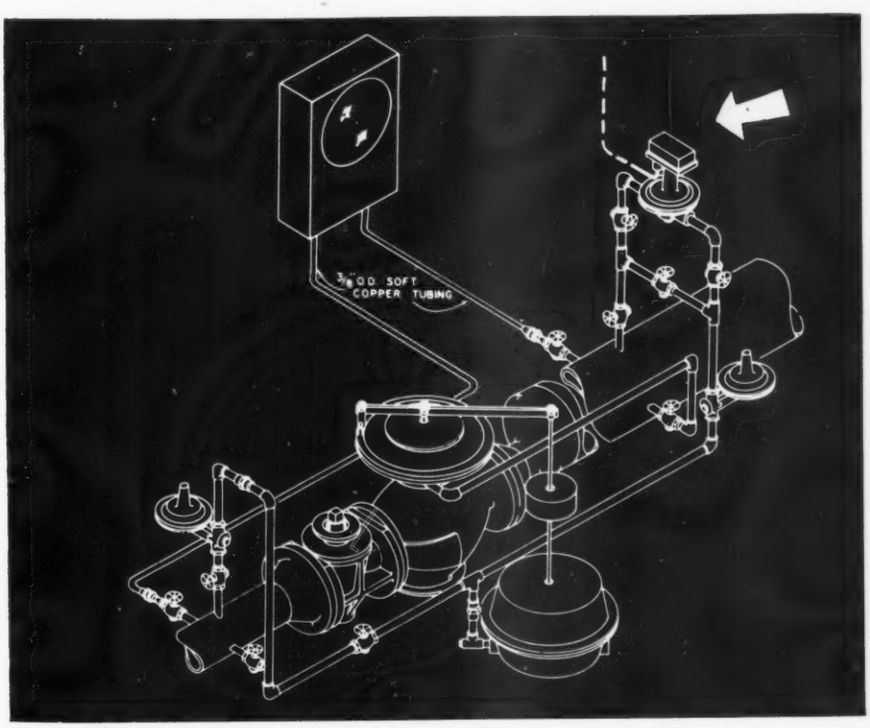


Fig. 1. Diagram shows arrangement of low pressure district regulator station with temperature booster, as used by Laclede Gas Company. Temperature device is at top right (arrow); sensing tube line is shown as dotted line, runs from vault to vent post base.

District Regulators Increased

At that time 260,000 of our total 320,000 customers were served by a low-pressure cast iron system. Studies indicated that, in our particular case, the economics were in favor of staying on low pressure and increasing system capacity by increasing the number of feedpoints or district regulators. From 54 district regulators in the 1948-49 season we increased to 104 district regulators in the 1950-51 season; at present we have 167 district regulators. In several instances it was necessary during the first couple of years to increase the pressure from 6 in. w.c. at the regulator outlet to 8 in. w.c. during extreme cold weather. This was done manually.

As time went by, we found that the number of regulators that required raising of the outlet pressure increased until about two years ago we were raising all of them. We also found that they required raising at somewhat higher temperatures than they did when we first started. This resulted in having to do the job more than once during the course of the winter.

Temperature Boosters Added

Quite naturally this leads to the idea of doing the job automatically with temperature boosters. We began installing temperature boosters in 1957. The past winter was our first season in which all the district regulators were working in this manner. During the 1957-58 winter, about one-half of the district regulators had automatic temperature boost.

We now operate and design the low-pressure system to maintain 8½-in. w.c. pressure at the regulator outlet and 4½-in. w.c. pressure at the system low point during the maximum hour. At temperatures above 65 F, the district regulator has an outlet pressure of 6-in. w.c., which provides approximately 5-in. w.c. pressure at the system low point.

All of our district regulators are of the weight loaded type using auxiliary pressure bowls to get accurate and positive lock-up. As this system of regulator control is somewhat different from that used on the regulators made by the manufacturer of the temperature boosters, we had to have the manufacturer supply us with a special controller. What makes them "special" is simply that the small regulator — which is part of the temperature booster — had to be designed for an inlet pressure of 23-in. w.c.

We omit the time element and vary the district regulator pressure in accordance with temperature only. In other words, we do not reduce pressure at nights. Our load characteristics are such that we could not reduce pressures before midnight and we would have to boost again around 3 a.m. The small savings that could be made by this short time of reduced pressure is not worth taking a chance on having a clock stop and fail to boost for the morning peak.

Booster Adjustment Experience

We have been well satisfied with the performance of this system during the past winter. A few "tricks" had to be learned. The most important was to learn not to fiddle with the controllers in an effort to get absolute accuracy. For example, let's assume that the controller is installed during warm weather. We try to set it up by using ice and brine to make the desired temperature boost. We begin boosting at 65 F and try to reach 8½-in. w.c. at 15 F. In the summer we may not be able to get our brine mixture lower than 30 F.

We make our adjustment assuming that the rate of boost is a straight line function. This is not quite true because it is a spring-loaded device. Then, when cold weather arrives, we may find that we reach 8½-in. w.c. at 17 F in some cases or that we may reach only 8¼-in. w.c. at 15 F in others.

Instead of making a readjustment on the first cold day, we have found it is better to leave it set in this approximate range for a while until we are sure of the individual controller's characteristic. These units do not perform with quite the same degree of reproducibility of results as does a dead-weighted device. We found it best to pull it into its final setting on the basis of average performance. After all, the maximum value of the district regulator's outlet pressure of 8½-in. w.c. is controlled not by the temperature booster but by the limiting regulator, which is a dead-weighted regulator.

Whether we reach 8½-in. w.c. at 14 F or 16 F is not too important when we have set the target at 15 F. In some locations, the effect of solar radiation and radiation from the ground at the beginning of the season on the temperature element can produce this much or even a little more variation.

Proper Installation Important

Thus far, our experience has not brought to light any serious operating or maintenance difficulties. Like any other control device, it must be carefully installed. The alignment of the push rod from the diaphragm of the temperature boost regulator must be aligned so that it properly engages the operating socket. All of our installations are in underground vaults and are thus subjected to the usual dirt and moisture conditions found in such locations. We are careful to see that the linkages are kept clean and properly lubricated so that small corrosion deposits do not interfere with the operation of pivot points. Other than these items, we have found no serious difficulties. * * *

Fig. 2. Temperature sensing bulb is mounted in cabinet at base of vent post used to vent district regulator in underground vault.

New

MERCOID®

LOW PRESSURE DIAPHRAGM CONTROL

FOR GASES OR AIR

PRESSURE — VACUUM — DIFFERENTIAL PRESSURE

FM
APPROVED
GAS PRESSURE CONTROL

Diaphragm operated

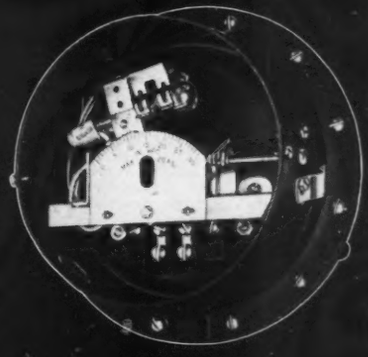
External adjustment

Visible calibrated dial

Hermetically sealed mercury switch

Visible on-off switch

Heavy gauge steel case (Nema 1)



CAN BE USED THREE DIFFERENT WAYS

For operation as a

POSITIVE PRESSURE CONTROL
NEGATIVE PRESSURE (VACUUM) CONTROL

DIFFERENTIAL PRESSURE
(POSITIVE OR NEGATIVE PRESSURES)

This control employs a diaphragm which actuates a mechanism for opening or closing a mercury switch. The diaphragm separates two pressure chambers, one of which may be used for positive pressure; the other for negative (vacuum) operation or both chambers may be used to provide operation due to a difference in pressures between them.

OPERATING RANGE: 1.0" to 30.0" (H_2O)
MAXIMUM PRESSURE: 20 Psig

FIXED DIFFERENTIAL (SENSITIVITY)

When operating point is set at

LOW	MEDIUM	HIGH
0.6"	0.8"	1.0"

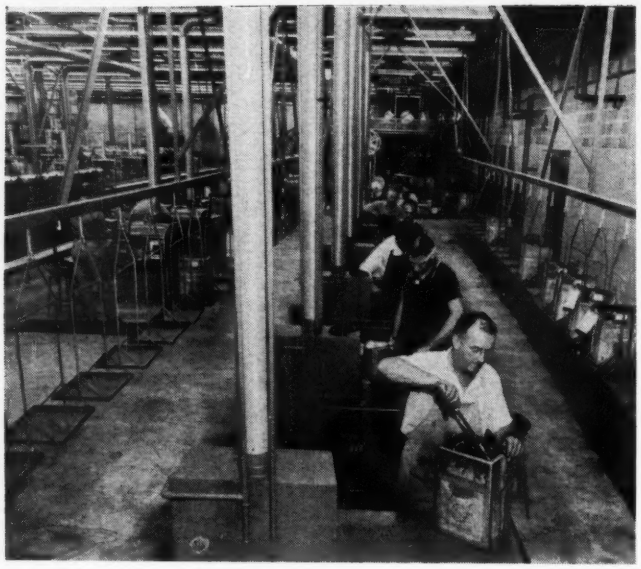
TYPES AVAILABLE

FULLY AUTOMATIC OPERATION: sp-st circuit opens on increase of pressure, vacuum or differential pressure; or sp-st circuit to open on decrease, (Available sp-dt or dp-st.)

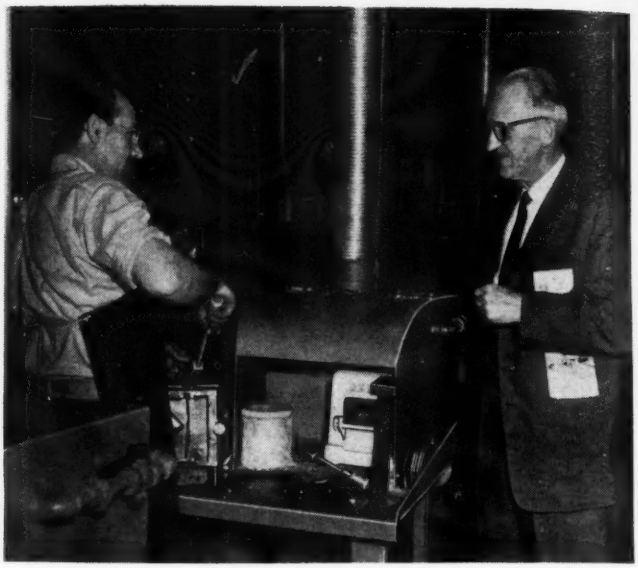
SEMI-AUTOMATIC OPERATION (With Manual Reset): Available to operate automatically on decrease or increase.

FOR FURTHER DETAILS WRITE FOR BULLETIN PG

THE MERCOID CORPORATION
4229 BELMONT AVENUE CHICAGO 41, ILLINOIS



Each small meter repair bench is equipped with a soldering iron furnace under a hood.



E. A. McGraw, Northern Illinois Gas Company meter superintendent discusses use of soldering iron furnace (under hood) with meter repairman Garnett Hopkins.

Gas-Fired Furnaces Speed Meter Repair Soldering

Charles A. McFadden, *Manager, General Industry Division*
Selas Corporation of America, Dresher, Pennsylvania

COMPACT, GAS-FIRED soldering iron furnaces are playing an important role in expediting meter maintenance at Northern Illinois Gas Company's new half-million dollar meter shop in LaGrange, Illinois.

The new shop is an outstanding example of equipment maintenance on a production-line basis. Some 60,000 meters are returned to the shop annually for maintenance and another 40,000 new meters per year are checked before installation. It was planned to handle approximately 175,000 meters annually by 1975. *(See page 41, November 1957 issue,* AMERICAN GAS JOURNAL).

Both new and old meters are unloaded at a two-truck dock and moved to one of two test areas. New meters that meet the stringent requirements for accuracy are placed on buggies or cargotainers ready for shipment. Used meters from the field are tested for accuracy, stripped of paint and sent on through the maintenance cycle.

Large commercial and industrial type meters are tested for accuracy, stripped of paint, and repaired within a separate, completely equipped area close to the loading dock. A monorail conveyor aids in handling the larger meters.

Smaller residential and commercial type meters are tested for accuracy, stripped of paint, and repaired in the small meter repair area, which is equipped with three overhead conveyors and a short conveyor belt to facilitate handling at the improving, adjusting, testing, and repairing locations and at the paint spray booth.

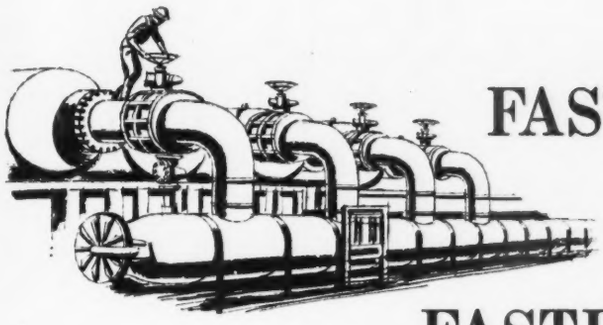
Meters requiring adjustment and repair are sent to the repair area after the tops have been unsoldered and removed. Repairs and adjustments are made at benches shown in photos.

With a number of gas-tight joints in the tinned metal sheets and tubes of tin case meters involved in repair operations, soldering is extensively used. In the gas-fired soldering iron furnaces, designed and manufactured by Selas Corporation of America, the irons are heated by a combination of radiant and convected heat.

Radiation is developed by a cup-shaped radiant burner that becomes incandescent when fired. This operation produces heat transfer rates higher than possible with conventional furnaces. The furnace recovers from 500 F to 1000 F in less than 4 minutes, burning less than 9 cu ft of natural gas per hour, when a cold 2-lb iron is inserted. With two irons, in normal use, the operator always has one iron within the soldering temperature range.

The furnace burns pre-mixed gas and air without flame impingement on the soldering copper, which is surrounded and protected by fully burned gases. Oxidation and burning of the copper and tinned surface is avoided, so that a bright, tinned working surface is retained without frequent retinning. A tilted shelf in front of the furnace deflects heat away from both operator and soldering iron handles. A flue at the rear of the furnace also adds to operator comfort.

After all evident repairs are completed at the repair benches, the meters are given additional tests, readjusted as necessary and the tops are then



FASTEST-GROWING FUEL in America's FASTEST-GROWING REGION

***El Paso Natural Gas Company** reports record deliveries of Natural Gas to customers in the West*

Natural gas is America's fastest-growing energy source, and El Paso Natural Gas Company and its subsidiaries serve natural gas's fastest-growing market.

Deliveries of gas were at record highs in 1958 as El Paso and subsidiaries continued to expand their pipeline systems and increase their gas reserves to meet the long-term energy demands of the West.

For the second consecutive year, gas deliveries totalled more than a trillion cubic feet.

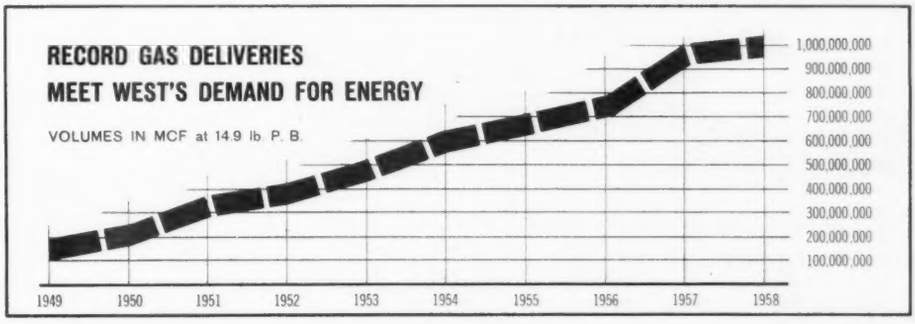
Extensive exploration and purchase programs brought total gas reserves at year's end to an all-time high of 38.8 trillion cubic feet—assuring vitally needed energy supplies for western consumers and industries in the years ahead.

El Paso's 1958 annual report, distributed to its 51,835 stockholders (an increase of 10 per cent in 1958) reports consolidated gross revenues for 1958 of $368,299,522, compared with 1957's $301,090,537. Net income was $35,308,813 in 1958, compared with $34,506,238 in 1957.

The report gives details of 1958's accomplishments, as well as plans to meet the future needs of western consumers—for natural gas, for petroleum, for petro-chemicals.

El Paso Natural Gas Company and its subsidiary, Pacific Northwest Pipeline Corporation, serve customers in California, West Texas, Arizona, Idaho, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming and Colorado.

For copies of El Paso's 1958 Annual Report to Stockholders, write to El Paso Natural Gas Company, El Paso, Texas.

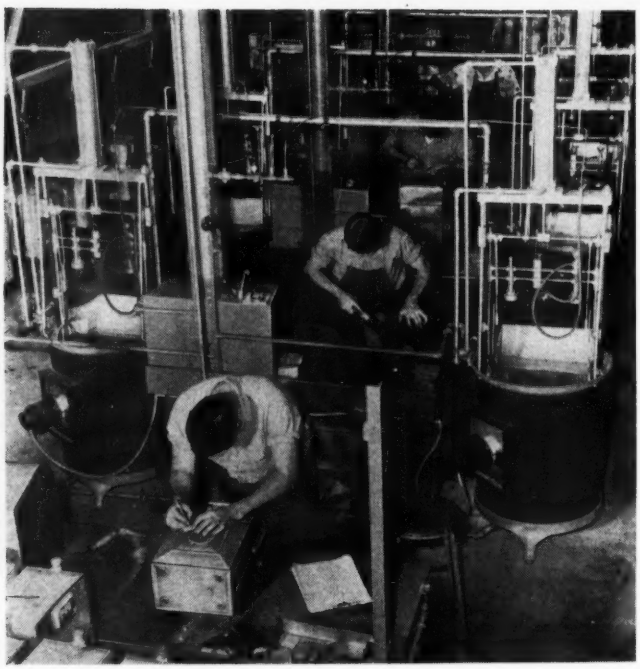


EL PASO NATURAL GAS COMPANY

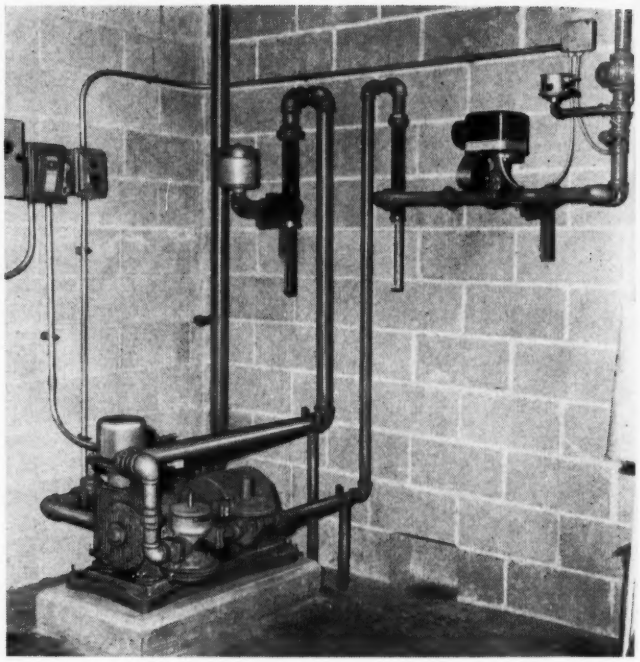
Common Stock listed on the New York Stock Exchange, Midwest Stock Exchange and Pacific Coast Stock Exchange.

Registrars: *New York, City Bank Farmers Trust Company; Chicago, The First National Bank of Chicago.*

Transfer Agents: *New York, The Chase Manhattan Bank; Chicago, Continental Illinois National Bank and Trust Company of Chicago.*



At final test benches, meters are given a water immersion test in tank at each end of bench; any leaks found here are repaired by soldering.



Gas combustion controller mixes gas (pipe at right) with air (filter at center), and supplies mixture at preset pressure and gas-air ratio to soldering iron furnaces through pipe behind compressor.

soldered on. Repaired meters, together with those that required only testing and repainting, are leak-tested by injecting air at 2½ psi into all meter compartments while the meters are immersed in water. Any leaks found during the immersion test are repaired by soldering at the benches. All good meters are then moved to the paint area where they are painted by automatic electrostatic spray.

A mixture of natural gas and air is supplied to the 25 soldering furnaces used in the shop by the Selas gas combustion controller. The gas-air ratio and mixture pressures remain constant at each furnace regardless of how many soldering iron furnaces are in operation. The controller is located in an out-of-the-way corner of the regulator repair shop. * * *

PROFESSIONAL DIRECTORY

EMPIRE GAS ENGINEERING CO.
P. O. Box 1738.
Atlanta 1, Georgia

LP-gas peak shaving and stand-by plants for
- municipalities
- industry
- design
- construction

COMMONWEALTH SERVICES INC.
Management and Business Consultants
300 Park Ave.
New York 22, N. Y.

ASSOCIATES INC.
Consulting and Design Engineers
209 E. Washington
Jackson, Michigan

OTHER OFFICES:
1 Main Street
Houston 2, Texas
1612 K Street N.W.
Washington 6, D.C.

DRAKETOWN PROPANE PLANTS
STANDBY
PEAK SHAVING
100% TOWN or PLANT SUPPLY
- Design
- Engineering
- Construction

DRAKE & TOWNSEND Incorporated
11 WEST 42ND STREET, NEW YORK 36, N. Y.

WHITMAN, REQUARDT AND ASSOCIATES
Engineers
Design—Supervision—Reports—Valuations
Publishers of the
HANDY-WHITMAN INDEX OF PUBLIC UTILITY CONSTRUCTION COSTS
now in its 35th year
1304 St. Paul Street
Baltimore 2, Maryland

Engineers, Designers and Manufacturers of
LP-GAS STAND-BY PLANTS
and special equipment for every requirement
BUTANE ALGAS PROPANE
TELEPHONE TRINITY 0845
AMERICAN LIQUID GAS CORPORATION
1109 Santa Fe Avenue • Los Angeles 21, California

APCO PROPANE-AIR MIXING SYSTEMS
Full Standby or Peak Shaving
Simple — Accurate — Rugged — Reliable
Package Units . . . Starting Service Included
Applied Engineering Company
P. O. Box 506
Orangeburg, South Carolina

BLACK & VEATCH
CONSULTING ENGINEERS
Natural Gas, Electricity, and Water Utilities
Production, Transmission, Distribution
Reports, Design, Supervision of Construction
Investigations, Valuation, and Rates
1500 Meadow Lake Parkway, Kansas City 14, Missouri (Since 1915)

LEAKAGE CONTROL SURVEYS
- Provide SAFETY & a 3rd Party Audit
- Reduce unaccounted—for losses
- Assist in economical & effective maintenance & repairs
- Conserve & protect Natural Resources

HEATH Survey Consultants, Inc.
378 Washington St., Wellesley Hills 81, Mass.

FASTER DELIVERY*

means PROMPT INSTALLATION —SATISFIED CUSTOMERS!

Join the BRYANT TEAM and enjoy a REPUTATION for RELIABILITY!

You're sure of having the *right* size and style always, when you sell Bryant home-comfort equipment. Your nearby Bryant distributor will see that you get *what* you need, *when* you need it. The complete Bryant line includes gas and oil furnaces and boilers, gas and electric air conditioners, unit heaters, water heaters and conversion burners.

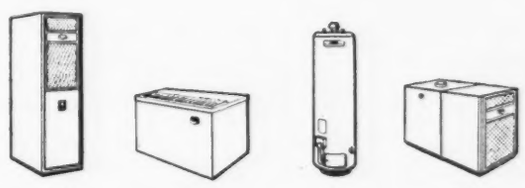
From your Bryant distributor you'll also get on-the-spot counsel, sales and technical training from experts, cooperative advertising and business management guidance to help you cut costs and *quickly* build sales and profits. You get *teamwork* with Bryant!

No other maker of home-comfort equipment offers so many exclusive features. No other line serves the entire heating and cooling market so well. *Get the profit facts!* Contact your Bryant distributor, or write Bryant Manufacturing Company, Indianapolis, Indiana. In Canada: Bryant Manufacturing Ltd., Toronto, Ontario.

bryant

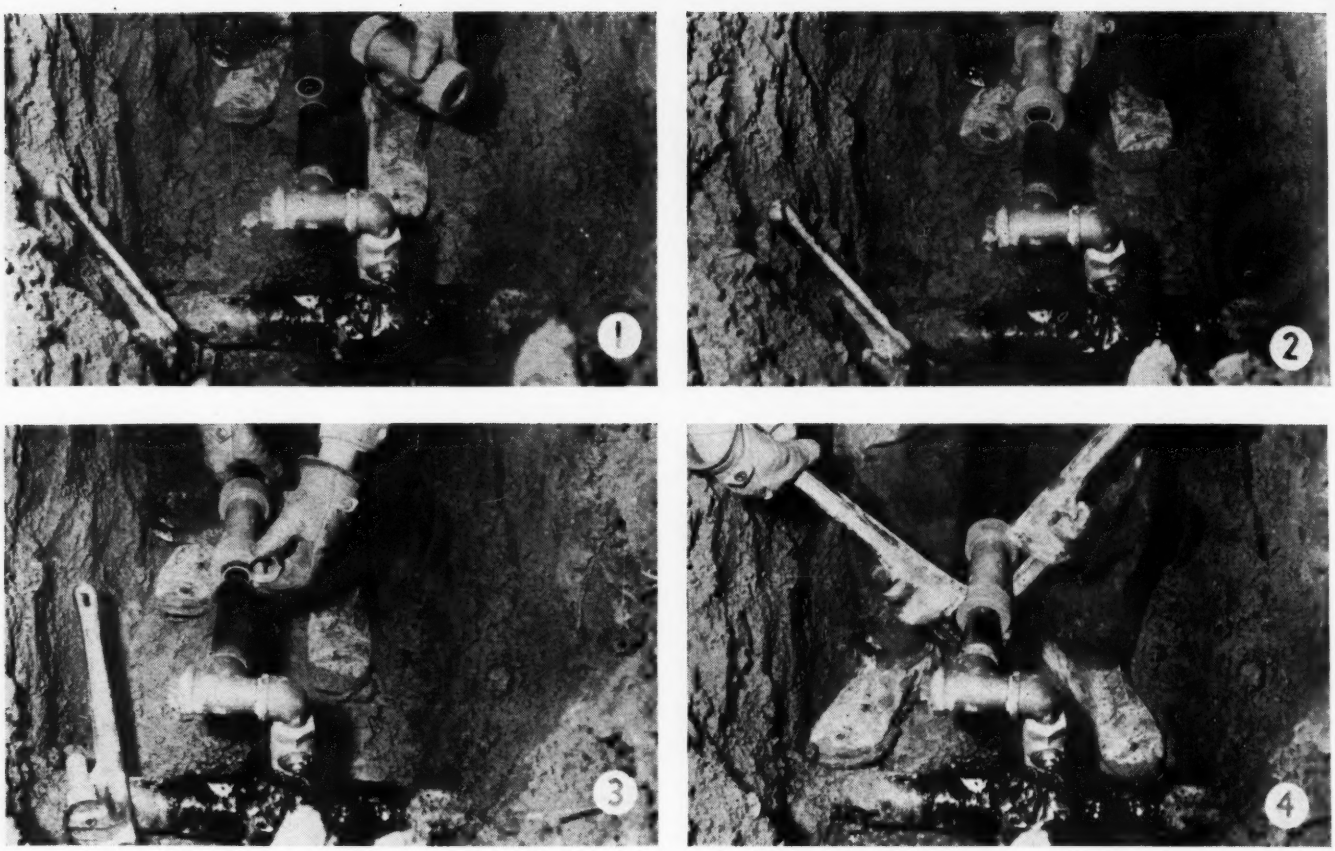
12 SOUND REASONS WHY YOU SHOULD BECOME A BRYANT DEALER!

1. **MULTIPLE LINES:** Furnaces, Air Conditioners, Boilers, Water Heaters, Unit Heaters—widest selection of models and prices to fit any market.
2. **EXCLUSIVE FEATURES YOU CAN SELL**—backed by 51 years of engineering leadership.
3. * **FAST DELIVERY**—from complete local stocks.
4. **COMPLETE FINANCING AND CREDIT ASSISTANCE**—suited to your needs—administered by local people who know *you*.
5. **ON-THE-SPOT COUNSEL**—sales, design, engineering, service—from your nearby distributor or factory branch.
6. **SALES AND TECHNICAL TRAINING**—by experienced specialists—both locally and at the Bryant plant.
7. **BUSINESS MANAGEMENT GUIDANCE** from factory and distributor, to help you cut costs, get more business, make more money.
8. **LOCAL AD CAMPAIGNS**—field tested—with Bryant factory and distributor participation.
9. **SOUND SELLING POLICIES**—in effect for over 50 years—protect your business and profits.
10. **BRYANT'S NATIONAL REPUTATION** with architects, engineers, builders, utilities and home owners helps *you* sell.
11. **GAS AIR CONDITIONING** gives you big opportunity to GROW—close tie-in with Gas Utility promotions.
12. **BRYANT'S FINANCIAL STRENGTH** protects your *future*.



389 Gas Furnace | 562 Air Conditioner | 148 Water Heater | 273 Oil-Fired Boiler

. . . YEARS AHEAD IN YEAR 'ROUND COMFORT!



New plastic compression type coupler for insulating service line connections helps prevent corrosion due to stray currents. Installation of the insulating coupler is shown above. In photo **(1)**, coupler is slipped over service line at point of connection to gas main tap. **(2)** Coupler has no molded ridge on inner surface, can be slipped completely onto one of pipes being joined, permitting easy realignment of pipe ends. **(3)** To keep pipe ends from making contact, a ½-in. plastic ring is inserted into gap before coupler is slipped back into position. **(4)** Rubber gaskets inside coupler ends provide tight, permanent seal when ends are screwed tight. Coupler can bridge gas from ½-in. up to several inches between pipe ends.

New Plastic Coupler Helps Solve Service Line Insulating Problems

AN EASILY INSTALLED plastic compression-type coupling has been developed to prevent corrosion caused by flow of stray currents in gas service connections.

The new fitting is an insulating connection made of high-impact unplasticized polyvinyl chloride for use in isolating gas service pipe from customer piping. The fitting has rubber gaskets that grip the metal pipe ends when the coupling is tightened and a sliding "spacer ring" of PVC that is inserted to keep the pipe ends from making contact with each other inside the coupler.

Corrosion caused by stray electric currents, often at vulnerable service connections, is considered a major cause of leaks, service interruptions, and high maintenance costs in gas distribution piping. Function of the PVC coupler is to prevent the flow of the stray currents from housing piping via the service line to the gas main. Similarly, the coupler helps prevent cathodic protection currents applied to the main from entering the house piping.

The coupler, which measures 6-in. end-to-end, is made to fit over 1¼-in. steel pipe. It can be slid over the pipe for its full length, permitting easy installation of the ½-in. spacer ring between the pipe ends being joined. The coupler can be used in either a new service connection or for isolating an existing line cut for insertion of the coupler and spacer ring. The coupler measures 4½-in. between the rubber gaskets, enabling it to bridge gaps from ½ to several inches between pipe ends. This feature, and the advantages of "slip-over" assembly can help reduce installation costs of pipe fitting and cutting in the field.

The new insulating coupler was developed in a cooperative effort between a major plastics manufacturer and a midwestern gas distribution company that wanted "foolproof" cathodic protection to replace its previous method of using short pieces of plastic pipe for insulation between its service lines and the customers' pipe. First permanent installations of the PVC slip-over coupler were made early in 1958. Excellent results have been reported in addition to sharply reduced installation time and costs. * * *

How Effective Are You As a Manager?

Here's a simple checklist of qualities that other gas industry executives think are important

Ernest W. Fair

NO MATTER HOW GOOD YOU MAY BE AT YOUR JOB, there are times when you will stop to wonder how effective you are, and what you can do to be better. This self-questioning is common among mature businessmen all the way up and down the executive ladder — from junior engineer to chairman of the board soon-to-retire.

It's a healthy ailment, however, and one that should be cultivated. When an individual becomes so sure of his ability that he no longer questions himself, he is likely to suffer from a worse disease — *delusion of importance.* When a man no longer requires mental self-examination, for his own good, he had better be ready to retire.

To aid those men who are still climbing the business ladder, a nationwide survey of gas distribution executives was made on the subject of "how to be more effective in your job." From this survey, here are a number of points to help you check up on yourself.

Do You Make the Most Of Your Personal Assets?

"In my case, it's largely a matter of **self-examination**," one executive in his late 40's said. "I'm firmly convinced that ability to make the most of personal assets is of greatest value to me. I keep checking these. I try to find particular ones that I have been neglecting and then proceed to cultivate them immediately. Appearance, speech, posture, etc., in particular I look for those that have kept me in good stead through the years and make sure that I keep them alive and active.

"I've found with myself, and observing others as well, that it's easy to take for granted such personal assets because they are so much a part of you. When you take them for granted, you start losing your effectiveness. That's why I lean back every once in a while and just reflect and re-evaluate to make sure I'm still utilizing all my personal abilities to the fullest extent."

Tired? Run Down? Been Ill Lately?

A number of executives mentioned **personal health** and **ability to defeat fatigue** during strenuous business occasions as being important barometers of effectiveness. No executive can do a good day-in and day-out job unless he has a reserve of energy to carry him through one difficult job after another. Long hours frequently accompany executive positions, and the reserves of energy that attend good personal health are necessary to carry the brain over long periods of strain and tension.

Trouble Concentrating?

Effectiveness also comes with **ability to concentrate.** The average executive — who finds it increasingly difficult to concentrate — might assume his ability to get things done is diminishing in direct ratio to his ability to concentrate.

Tiny distractions, interruptions, sidetracking of thought patterns — all in themselves unimportant — eat away at his ability to concentrate and carry a project through to successful completion. Increasing irritability with subordinates, or ringing telephones, leaky pens, etc., are symptoms of strain that are very much like friction on a fine automobile engine that eat away at rings and valves and cause inadequate compression and resultant misfiring, loss of power and **no go.**

To remove the trouble, discover the origin; what is distracting you, disturbing your ability to concentrate? **Do something about it!**

Almost every man surveyed has experienced lagging attention at one time or another. Some of the suggestions to revive interest and eliminate tension were:

Take time out to solve bothersome side problems,

Clear the desk so you can concentrate on one problem at a time,

Leave the room,

Take a short walk to the water fountain.

Turn to something new, relax the mind by distracting it completely to a new subject, new environment. Then return to the problem.

If difficulties continue, all executives suggested take a rest and maybe a long vacation.

What Was His Name?

Peak effectiveness calls for **continuing good memory.** In today's management, memory for faces, names, technical details is increasingly important — it is an ability that must be used continually, and it is one that is also harder to retain as the years go by. It is an ability that is easy to lose by small degrees so you are never aware of how badly you have slipped until too late. Despite hundreds of modern filing aids, there are still innumerable occasions in the day of a gas distribution man when he must rely on memory.

Ready to Dig In?

Good sign of effectiveness is the **ability to dig in** on any problem you meet, and particularly so on new problems and new assignments. Don't defer or postpone solution of new problems or assignments. Putting the letter in the desk drawer, or pending file *out-of-reach, out-of-sight,* is a sign of ineffectiveness.

"When I realize I have slipped into this bad habit, I just stop and recall my younger days in the business," one executive recounted. "I recall how much more I accomplished in those days because of my youthful eagerness to get at any new assignment that came my way. This points up to me the importance of getting back into that frame of mind if I hope to be as effective on those tasks I have to handle today and tomorrow."

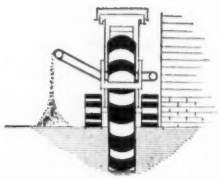
Do You Generate Enthusiasm?

Keen interest in what one is doing not only lightens your own task, but

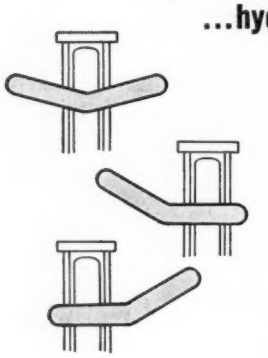
THE MACHINE / for distribution digging

...the new Cleveland J-20 trencher

- less than 5' wide over its crawlers
- digs 13" to 24" wide, down to 5' 6" deep
- puts 24" trench within 20 inches of a parallel wall
- maneuverable full crawler mounting... perfect balance and stability, easy on lawns and sidewalks
- fast, accurate, clean, dependable... nothing digs trench like a Cleveland

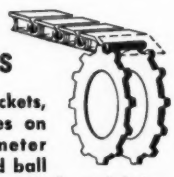


Cleveland's unique new V conveyor ...hydraulically shifted... independently driven



- digs past poles, trees, shrubs... places spoil where needed — without interrupting other operations
- lever at operator's seat controls hydraulic shifting and positioning of conveyor
- dual independent hydraulic drive gives operator fingertip control of conveyor belt direction and speed — independent of all other operations
- self-contained hydraulic motor and planetary gear drives in each head pulley eliminate all conveyor chains and sprockets
- provides constant elevating angle for faster, higher spoil discharge
- Maximum clearance under digging wheel rims permits higher heaped loads without clogging
- conveyor design reduces rolling and tumbling

world's finest trencher crawlers



...double flanged sprockets, rollers, wheels... drives on each end of 1½" diameter hardened pins... sealed ball and roller bearings... 1,000 hour lubrication... a tremendously long-lived, easy-rolling track.

hydraulic crumbing shoe

...optional, extra... pivots upward... fingertip control makes crumbing shoe advantages practical in crowded digging conditions.

engine • crawlers • hoist • wheel crumbing shoe • conveyor speed-direction-shift / *Every operation controlled at operator's seat*

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

generates enthusiasm in others. This enthusiasm, in turn, changes a job from a chore to a pleasure of accomplishment, self-fulfillment, or conquest of another pinnacle in the business road. Keen interest has an intangible ability to bowl over obstacles, distractions and disagreements thrust in the way.

Do People Like You?

How well you **get along with other people** is an important point to check. Modern business is so inter-dependent that the self-made man is almost an extinct symbol of yesterday. True effectiveness, no matter where you may be working, cannot exist without the full cooperation of everyone with whom you work.

When associates grudgingly assist in a job, it's time to check, re-evaluate, and do something about it. Retrace your instructions. Too brusque? Incomplete? Remember that the other man wants to do a good job. Give him a job and let him carry it through. Praise him when it's due, or couch criticism on the constructive side. Remember, too, subordinates are eager to do the job right because they want to get ahead. A good way to check your own effectiveness is to analyze the attitude of the people with whom you work.

When orders are received with enthusiasm and carried out promptly to an individual's best ability there is assurance of good organization. When assignments are greeted with indifference, or compliance results only because continued job security demands it, you can be assured of diminishing "esprit de corps" and probable sagging employee morale. When you fail here, the whole structure of the "organization," in the complete sense of the word, becomes shaky.

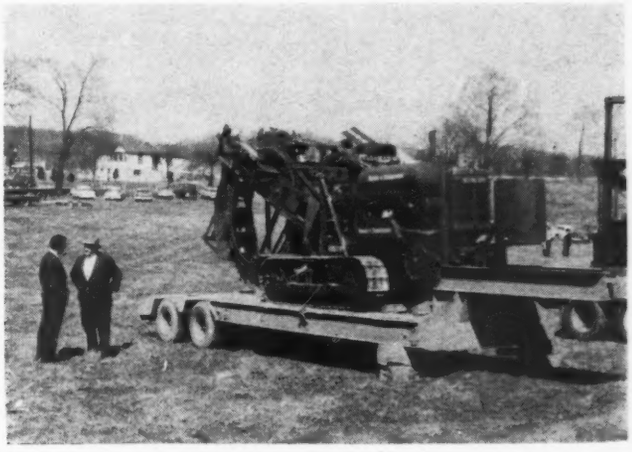
"Open Door" Policy on New Ideas

Another point frequently checked as necessary for an effective supervisor is how well he **keeps up with modern trends** in business and particularly developments in "tools and methods." These cannot be neglected if you want to keep up in the modern world. New ideas, tools, and methods should be explored and utilized if possible. "Old reliables" do not attain sanctity by virtue of their "always having been done that way."

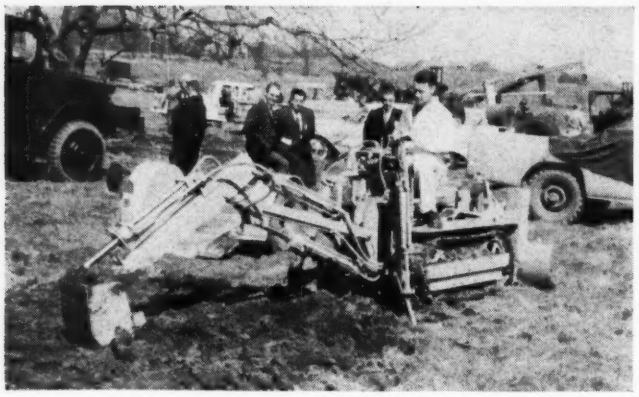
In your self-questioning period, remember that constant attention is needed to assure yourself that you are getting the most from your own inherent abilities. Take special note of your personal health, physical stamina, ability to concentrate, good memory, enthusiasm and interest, ability to meet problems head on, open mind to new ideas, and how people react to you. *

Construction Equipment Pictorial

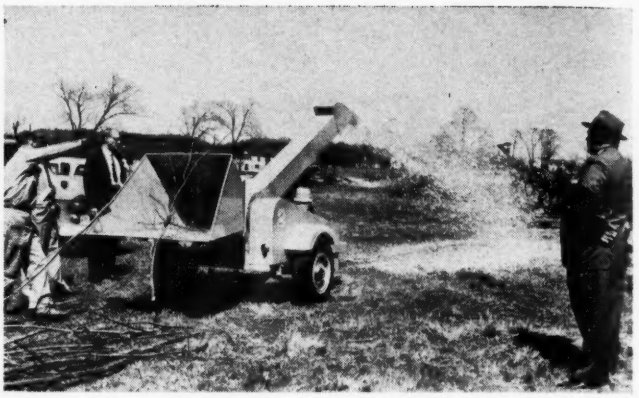
Gas distribution company operating men attending the 1959 A.G.A. Operating Section Distribution Conference in Cincinnati took "an afternoon off" from regular meeting-hall sessions to inspect a display of mobile and automotive equipment. The exhibit, complete with demonstrations of the latest in construction equipment available to gas utilities, was sponsored by the *Joint A.G.A.-E.E.I. Automotive and Mobile Equipment Committee*. First display of its type to be offered at a Distribution Conference, it was well received by conference attendees. For the benefit of its many readers unable to attend the Conference, *American Gas Journal* presents here an exclusive photographic report on equipment items of interest to gas distribution company construction, maintenance, and service personnel.



TRENCHERS, big and small, were on hand at the exhibit. At top, left, is Cleveland Trencher Model J-30. At top right, Cleveland's new Model JS-30, which has a power-shifted digging wheel. Below, left, Dwaine Goldsberry of Charles Machine Works, Inc., demonstrates a Model C-3 Ditch Witch. Below, right, new Model K-1 Ditch Witch, a small but versatile rider-type trencher complete with backfill blade, is demonstrated by Howard Worthington.

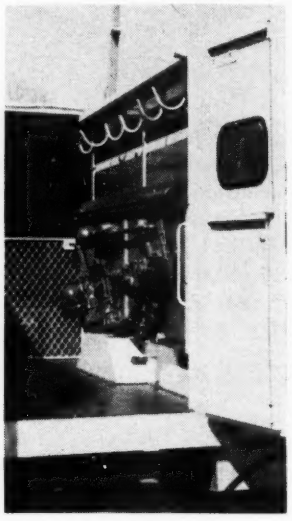


Small but mighty Agricat, equipped with an Agrihoe, is demonstrated for group of interested gas distribution construction men.



Disposing of brush, shrubs, etc., removed from the right-of-way is no problem when using the Asplundh Brush Chopper; it simply makes little chips of large sticks.

Powers-American Series 850 Gas Construction Body equipped with a Worthington Blue Brute power take-off driven air compressor and air tools.



Inside body, all air tools are conveniently racked on side for easy access.

W. J. Fleming of Worthington demonstrates features of new air-operated sump pump.

Arrow Mobile Hydraulic Hammer features automatic impact control and "creeper gear" to move hammer at uniform speed for cutting, breaking, and tamping operations.

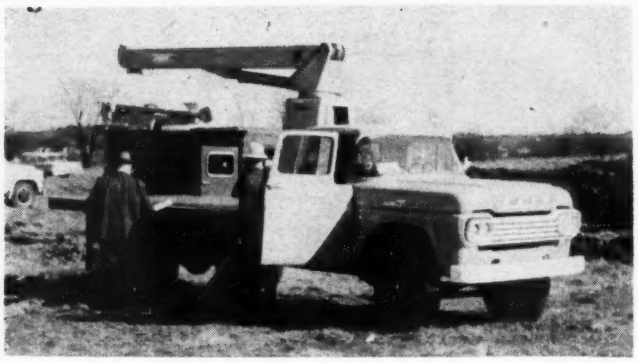
Gas distribution construction men view two Gar Wood-Buckeye trenchers in operation. In foreground is Model 403 Ladder-Type Ditcher for service line work; in background, Model 305 Wheel-Type Ditcher for service line work.

"Universal" Jeep is universal, as evidenced by various equipment applications of the sturdy little vehicle displayed at Cincinnati. At left, top, Jeep-mounted "Go-For-Digger" cuts service line and then (bottom left) uses quick-change angle-dozer blade to backfill.

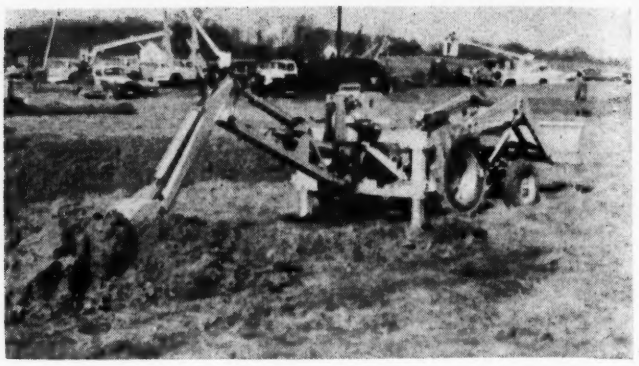
Jeep equipped with Lincoln Arc Welder (at right, top photo) is demonstrated; unit is made by A. J. Parsons Company. At right, bottom photo, is Jeep Model FC-150 equipped with trencher and front end dozer blade for backfilling, owned by Cincinnati Gas & Electric.

"Muffler" for Ingersoll-Rand's air hammer, demonstrated here by American Gas Journal's Art Gilliam, cuts noise up to 55 percent — a decrease welcome when working in hospital zones and similar areas. In background is I-R's Model 85 Gyro-Flo portable air compressor, also demonstrated.

Ability of Bucyrus-Erie Hydrohoe to dig trench at high speed is demonstrated in photo above, while companion Hydrocrane equipped with clamshell bucket (left) takes big bites smoothly.

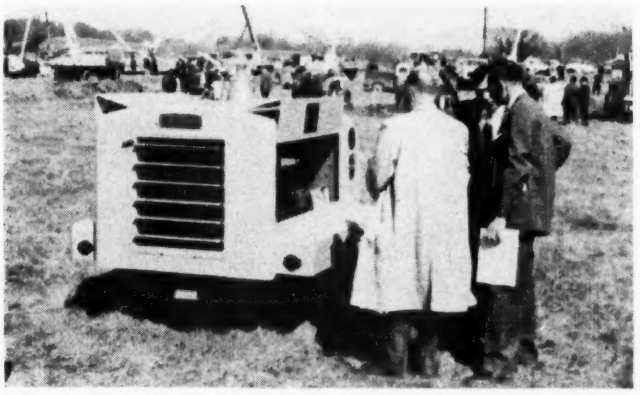


Pittman Hydra-Lift demonstrated at mobile equipment show is versatile truck-mounted crane ideal for many material handling jobs, including pipe, valves, etc.



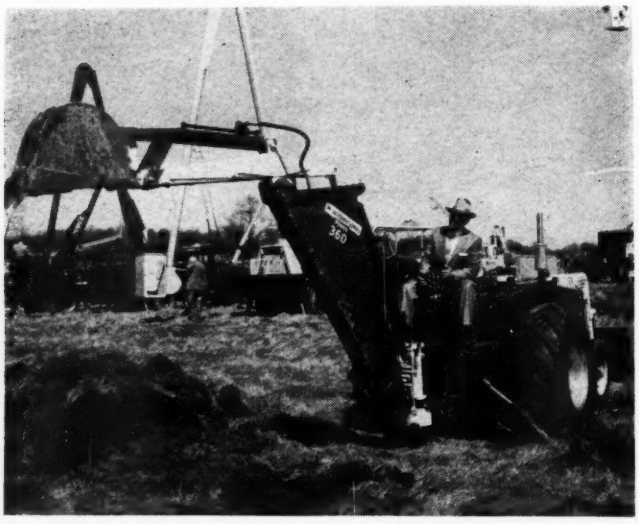
Massey-Ferguson Model 202 "Work Bull", equipped with Davis Model 185 Backhoe and Model 101 Front End Loader, is versatile unit for digging, trenching, and backfilling.

Barber-Greene's new Model 772 Wheel Ditcher, below, designed for utility company applications, digs its way across exhibit area. Unit is also available as Model 773 with wider tread and wider track pads.



Le Roi Model 125 Portable Air Compressor is demonstrated to group of gas distribution company construction men.

Ottawa "Big Muscle" Backhoe, right, mounted on Chevrolet truck, characterizes speed, mobility, and versatility of modern equipment displayed.



International-Pippin 360 Backhoe and Front End Loader gets trial run by Lawrence Lehnert, assistant general foreman, construction and maintenance, gas operations, Cincinnati Gas and Electric, during display.

Al Bene, assistant superintendent of construction and maintenance, gas operations, at Cincinnati Gas and Electric, tries his hand at operating Auburn Trencher mounted on Massey-Ferguson "Work Bull" Tractor.

how pipe line engineers can sleep better

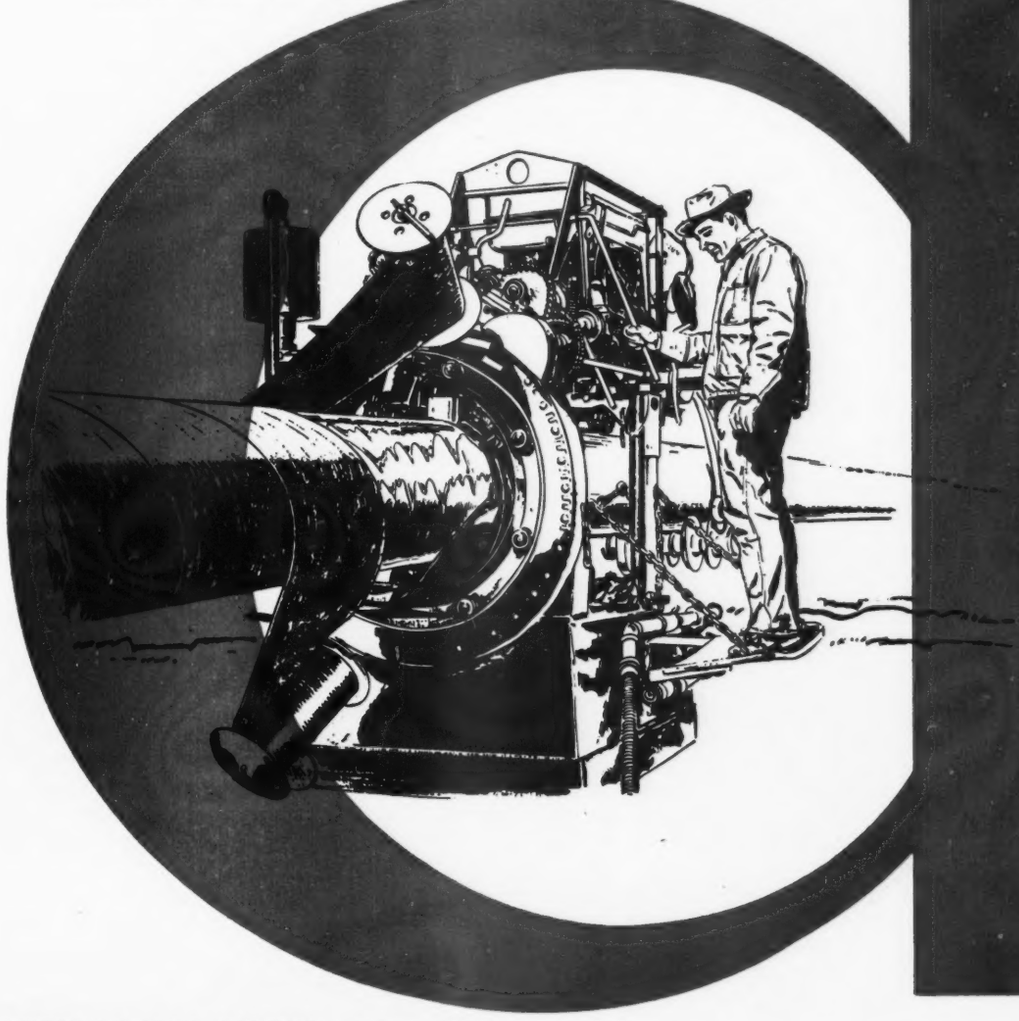
Dearborn's NO-OX-ID coatings and wrappers aren't exactly sleeping pills but the engineers who specify them for transmission or distribution systems don't have restless nights worrying about corrosion break-throughs.

NO-OX-ID provides both chemical and mechanical protection against moisture penetration and soil action. It is protection that lasts for decades — under ground and even under water. In tests, NO-OX-IDs have completely protected highly susceptible metals submerged in ocean locations year after year.

There's a NO-OX-ID coating or wrapper especially suited to your particular job and available for over-the-ditch or other type applications. Ask a Dearborn engineer.

DEARBORN CHEMICAL COMPANY

Merchandise Mart Plaza • Chicago 54 • Manufacturing Plants: Chicago • Linden • Los Angeles • Toronto • Honolulu • Havana • Buenos Aires



pioneer in the science of corrosion control

dearborn

AMERICAN®
insulated
meter connections

permanent
molded-on design
simplifies assembly

- Insulation covers pilot flange and extends up the body—minimizes possibility of short circuits caused by moisture. No loose parts.
- Tough Nylon insulation seals tight, resists crushing. High dielectric strength eliminates electrolysis.
- Insulated meter connections are interchangeable with standard connections—accepts standard caps and washers. Reduces inventory problems.

Ask your American representative for Bulletin 308 describing all insulated and standard meter connections.

AMERICAN® METER COMPANY
INCORPORATED ESTABLISHED 1836

Executive Offices: Philadelphia 16, Pa.
Sales offices in principal cities.

DISTRIBUTION DEVELOPMENTS

Atlanta Gas Light Company, Atlanta, Georgia, has just completed installation of a basic system of feeder lines in South DeKalb County consisting of approximately 100,000 ft of main in the Flat Shoals Road area from Southwest DeKalb High School to Snapfinger Creek, the community of Snapfinger, and the Bouldercrest-Cedar Grove area. Plans are now being completed to improve interconnection of the Rome-Atlanta systems. Proposed is the elimination of the Southern Natural Gas Company metering station south of Rome by laying approximately 5 miles of 6-in. from the Lindale station directly to the Cartersville line to create a straight Atlanta Gas Light connection from Atlanta to Rome. In north Fulton County company crews have laid 17,000 ft of mains north of the Chattahooche River to connect new customers in the newly-franchised area of Roswell. Nearly 750 meter orders have been accepted. In Gwinnett County, 900 new customers have been connected, and installation of new mains in the newly-franchised area of Snellville is under way. Atlanta Gas Light's total construction program for 1959 is estimated at approximately $8,788,000.

Wisconsin Public Service Company, Milwaukee, Wisconsin, has begun construction of 2 to 12-in. main extensions in its distillation systems in Sheboygan, Green Bay, Stevens Point, Marinette, Two Rivers, Oshkosh and Menominee, Michigan, as part of its 1959 construction program. Contractor for the project is Gabe's Construction Company. Completion date is set for December 31, 1959.

The Gas Service Company, Kansas City, Missouri, has its $5,864,000 1959 construction program well under way with two new distribution systems in Verona, population 350, and Freistatt, Missouri, population 150, scheduled for completion in early summer. Contractor is Luther G. Harper Construction Company of Tulsa. Both towns will become part of the Monett Division. Western Missouri Gas Company is constructing one mile of main line to serve Freistatt and two miles to serve Verona.

Consumers' Gas Company of Toronto, Ontario, has completed its 19-mile extension from Lindsay at a cost of $647,000 to bring natural gas to the recently-acquired propane-air distribution system in Peterborough. Conversion of approximately 2000 residential, commercial, and industrial customer appliances has been completed and further extensions of the distribution system to supply additional customers in the city of 42,000 are planned. Consumers' has budgeted a total of $16,567,000 for new construction on its distribution system in 1959.

Houston Natural Gas Company, Houston, Texas, has recently completed construction of two district regulator stations and a new city-gate station in Freeport, Texas. Feeder lines to bring additional gas to Freeport are also under construction by Houston Pipe Line Company, affiliate of the distribution system.

Northern Ontario Natural Gas Company, Ltd., and **Twin City Gas Company, Ltd.,** both of Toronto, Ontario, have construction under way to install more than 250,000 ft of new gas mains in northern Ontario to connect new customers in Fort William, Port Arthur, Timmins, Sudbury, North Bay, and Orillia. Bulk of this year's construction effort will be to extend coverage of distribution systems installed last year to include residential areas now located on the fringe of present systems. Approximately 180,000 ft of 2-in., 50,000 ft of 4-in., and 20,000 ft of 6-in. are scheduled to be installed. During 1959, approximately 13,000 additional service lines will be laid.

North Carolina Natural Gas Company, Fayetteville, North Carolina, is well under way with its $3,139,000 1959 construction program. Construction of approximately 40 metering stations in North Carolina is scheduled for completion by July 15; installation of distribution systems in Rockingham, Aberdeen, Southern Pines, and Hamlet are scheduled for completion by June 15. Contractor is Latex Construction Company. Distribution systems in six other towns are being built by Panama Williams Corporation and scheduled for completion by June 15. Engineering-Construction Company has just completed distribution systems in Laurinburg, Raeford, Roseboro, and St. Pauls. Distribution systems in Benson, Dunn, Erwin, and Lillington were completed by Engineering-Construction Company late in April.

PRODUCT PARADE

MATERIALS – EQUIPMENT – SERVICES

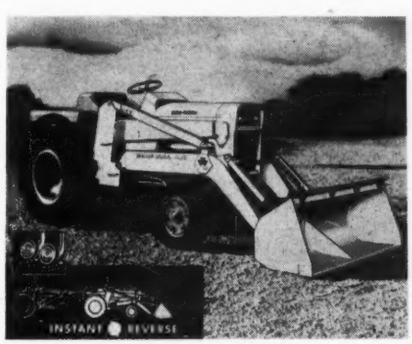
TALKING GASLITE is now available from Arkla Air Conditioning Corporation.

New remote loudspeaker attachment for special use with *Gaslites* has been developed by the engineering and research staff of Arkla; may be used with any radio, phonograph, or public address equipment. It is particularly adaptable for paging guests at hotels, motels, clubs, and the like. Attachment consists of two speakers mounted on a Gaslite post just under the lamp case; is available as optional equipment for new or existing Gaslite installations.

CIRCLE (1) ON THE REPLY CARD

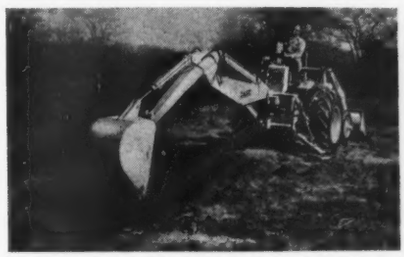
ULTRAVIOLET AIR PURIFYING ATTACHMENT for Arkla-Servel Sun Valley gas air conditioners substantially reduces both bacteria and home odors present in the circulating air stream. Development of the device marks the first time germ and odor-removing features have been made available for residential gas central air conditioning systems. Device consisting of two tubular ultraviolet lamps and related equipment will be optional on 1959 model Sun Valley gas units. Attachment kills about 75 percent of the air bacteria, and substantially removes odors such as tobacco smoke and cooking odors. Surveys have shown that the use of ultraviolet radiation in hospital operating rooms has reduced post-operative infection by over 85 percent; and at a school in New York state it cut down pupil absences due to illness by 66 percent.

CIRCLE (2) ON THE REPLY CARD



NEW MODEL INDUSTRIAL TRACTOR-LOADER from Massey-Ferguson Industrial Division features no-shift reversing, a torque converter, and 5 equal speeds in either direction. Multiple-disc hydraulically actuated reversing clutches provide no-shift reversing; the 60.3 bare engine horsepower gives rig plenty of speed and power. To control directions, operator depresses right pedal to go forward and left for reverse. Foot pedals also control rig's speed of movement forward or backward. Advanced power steering and a torque converter that adjusts speed to load requirements are among other features of the Work Bull 406. Unit has direct-line thrust for bulldozer type action, and the telescoping lift arms permit 126-in. lift height at the hinge point.

CIRCLE (3) ON THE REPLY CARD

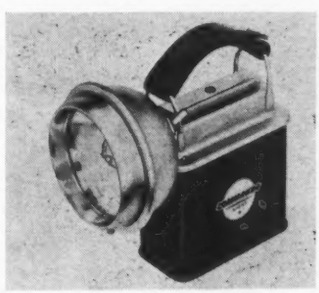


J. I. CASE COMPANY's new model utility 10-ft digger has ample reach to cut 15 ft of trench from a single position. Unit is designed for trenching, backfilling, loading and low-cost everyday digging at practical depths to 10 ft. Backhoe cuts 10 ft deep, reaches over 15 ft, side casts or loads into trucks up to 10 ft high. Individually controlled telescoping stabilizers permit vertical trenching on side slopes up to 10 deg. Hydraulic 180 deg swing is foot-controlled to speed dig-and-dump cycles by allowing operator to work boom, crowd, and bucket while pivoting. Backhoe is quickly removed for installation of front or side mowers, or a score of other quick-hitch tools for grading, landscaping, tilling, and specialized work.

CIRCLE (4) ON THE REPLY CARD

COMPLETE LINE OF GAS HEATING CONTROLS including diaphragm gas valves, automatic pilots, and regulators are now being marketed by Penn Controls, Inc. Diaphragm gas valves are available in ½ to 3-in. sizes. Combination diaphragm gas valves, automatic pilots, and regulators are available in ½-in. small, ½-in. large, and ¾-in. sizes and may be supplied with manual opening, electric reset, and 100 percent shutoff.

CIRCLE (5) ON THE REPLY CARD



NEW SAFETY SPOTLIGHT has been added to Davis Emergency Equipment Company's line of industrial safety equipment. The new stainless steel dry-cell lamp throws a 1500 ft beam of 15,000 beam candlepower; is possibly the most powerful dry-cell safety spotlight on the market. Adjustable focus permits instant selection of either spot or diffused light. Power is supplied by standard 6-v double pack battery. Has been approved by both U. S. Bureau of Mines and U. S. Coast Guard for Class 1-Group D use.

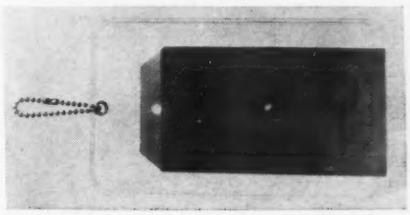
CIRCLE (6) ON THE REPLY CARD

APPLICATIONS of the first sprayable high-density polyethylene coating developed by Koppers Company include lining for pipelines and as tank coatings for highly corrosive solvents. New coating is free from pinholes, has outstanding adhesion qualities on a variety of surfaces, superior impact resistance and flexibility on metallic surfaces, and can be applied clear or in a variety of colors.

CIRCLE (7) ON THE REPLY CARD

PHILCO'S NEW GAS DUOMATIC WASHER-DRYER is so compact it can be installed in the kitchen — only 26¾-in. wide by 26¼-in. deep by 36-in. high. Model incorporates advances in design which give gas new competitive advantages in the automatic home laundry field — substantially faster washing and drying. Up to now gas and electric versions of the same model and brand of dryer or combination washer-dryer have dried at practically the same rate of time. Installation of the combination washer-dryer in or adjacent to the kitchen stimulates increase in average monthly use. Eventual appliance saturations of from 50 to 75 percent are now realistic goals for gas utilities. Load building potential of new appliance is 6 to 9,000,000 therms of annual load per 100,000 residential meters, based on eventual saturations of from 50 to 75 percent.

CIRCLE (8) ON THE REPLY CARD



PLASTIC TAG PROTECTOR allows ordinary paper tags to be used where more costly metal tags have previously been required. The clear plastic tag protects paper tags from weather elements, when used outside. Can be used indoors on appliances or meter repair where tags are subject to becoming soiled easily. Paper tag remains legible indefinitely when used in plastic tag protector. Available in 3 sizes which enable user to purchase suitable size for any standard size paper tag he is using.

CIRCLE (9) ON THE REPLY CARD

PRESSURE ON THE HANDLE of Ridgid compound leverage wrench doubles that of regular, equal jaw size pipe wrenches and offers added advantage of shorter handle for work in close quarters. One man can do the work of 2, and 2 can do the work of 4 with the new wrench from Ridge Tool Company. Can be used to tighten or loosen right or left hand threads, with the pipe on either side of the fitting. Available in 4 sizes for 2 to 8-in. pipe.

CIRCLE (10) ON THE REPLY CARD

NEW LUMINOUS RED WARNING FLAG from Industrial Products Company provides greater "job" protection, and extra visibility day or night. Made of vinyl-bonded-to-nylon material with super strength dacron stitching, warning flag is uniformly bright on both sides. Thermally reinforced edges provide exceptionally high tear strength. Diagonal reinforcing stay assures "windproof" action. Available in 13, 16 and 18-in. square sizes.

CIRCLE (11) ON THE REPLY CARD

THE *FINEST* FOR MODERN GAS DISTRIBUTION SERVICE

NORMAC

Insulating Fittings

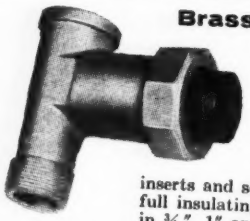
Malleable Service Ell

The insulating principle depicted above is carried out in all Normac Ells and Tees.

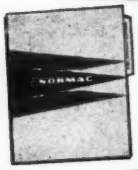
Malleable Couplings

Normac Insulating Malleable Couplings and fittings are available with polyethylene inserts and semi-insulating gaskets or full insulating rubber gaskets.

Brass Fittings



Normac insulating Brass compression end Tees, Ells and all compression end fittings are available with polyethylene inserts and semi-insulating or full insulating rubber gaskets in ¾", 1" and 1¼" iron pipe sizes.



New CATALOG

Write for your copy . . . it gives complete details and specifications of NORMAC equipment.

NORTON-McMURRAY Manufacturing Co.

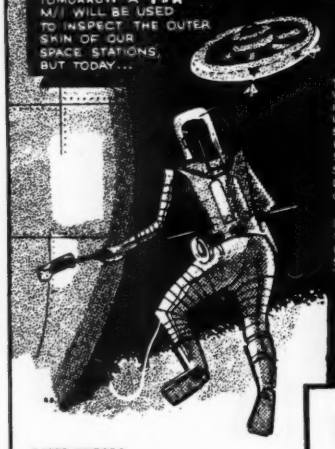
919 North Michigan Avenue

Couplings • Meter Bars • Sleeves • Cocks

Bell Joint Clamps • Service Tees and Ells

DESTINATION: TOMORROW!

TOMORROW A T&R M/I WILL BE USED TO INSPECT THE OUTER SKIN OF OUR SPACE STATIONS, BUT TODAY...



THE MODEL M/I DECTECTOR IS A LOW VOLTAGE ELECTRICAL INSPECTION INSTRUMENT THAT WILL ACCURATELY INDICATE PIN HOLES, VOIDS OR BARE SPOTS IN A SURFACE COATING WITH HIGH ELECTRICAL RESISTANCE. WHEN SUCH COATING IS BRUSHED OR SPRAYED ON AN ELECTRICALLY CONDUCTIVE SURFACE SUCH AS STEEL OR CONCRETE.

BECAUSE OF ITS LIGHT WEIGHT - LESS THAN 5 POUNDS - THE M/I CAN BE USED ON TOWERS, BRIDGES OR STRUCTURES WHERE IT IS NECESSARY TO CLIMB.

DISTRIBUTORS

Crutcher-Rolfs-Cummings Inc.
Houston, Texas
Remco Manufacturing Co., Inc.
Tulsa, Oklahoma
Canadian Equipment Sales & Service Ltd.
Edmonton, Alberta, Canada
Bob Herrick Rentals & Service
Harrisburg, Penna.
Falcon Line Products Corp.
Elizabeth, N.J.
Export Agents . . . Frazer & Hansen Ltd.
San Francisco, Calif.

Electronic Detectors for every Industry

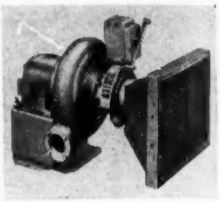
TINKER & RASOR

417 AGOSTINO ROAD, P. O. BOX 281, SAN GABRIEL CALIFORNIA

PRODUCT PARADE

GAS LIGHTS are now available in colored finishes to match architectural decor and trim from Falcon Manufacturing Company. Finishes include classic bronze, traditional copper-tone, white, or black. Post or wall brackets are also available in matching colors. All finishes are bonderized and phosphated to give them life time durability.

CIRCLE (12) ON THE REPLY CARD



ECLIPSE FUEL ENGINEERING COMPANY'S new line of air filters for use on air-gas premixers and centrifugal pressure blowers used in gas combustion systems protects against entry of foreign material and prevents changes in the critical gas-air mixtures, the plugging of burner ports, and undue rapid equipment wear. Units are available in single or double-element styles, and can be changed in a matter of seconds through a "snaping" arrangement.

CIRCLE (13) ON THE REPLY CARD

NEW PIPE PUTTY, designed to take the sharp corners out of pipe fittings prior to the application of pipe protection tape has been announced by Minnesota Mining and Manufacturing Company. Called "Scotchrap" brand pipe insulation putty, new compound was developed to make taping of irregular shapes such as tees and couplings better and easier. It provides a smooth taping surface, practically eliminating wrinkles and buckles in the tape.

CIRCLE (14) ON THE REPLY CARD

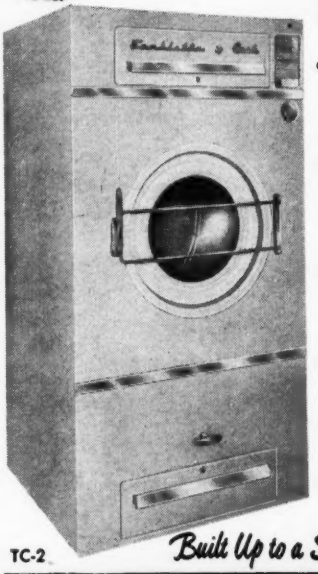
Pilot Light Definitions: *Scrubbers,* equipment designed to remove dust, rust, scale, old roustabouts and pipeliners and other foreign matter from our product before it reaches the customer; *Tractor,* machine with which to make tracks; *Orifice,* opening that lets gas through one at a time; *Meter Reader,* person who periodically opens meter boxes looks at the meter and reads the dial; sometimes called a "dialaphile."

Tumblette by Cook

37 x 30 GAS HEATED DRYER

GET THE FACTS — *Compare!!*

•MORE features •MORE dependability



NEW LOWER Meter Location
LOWER Cabinet Height

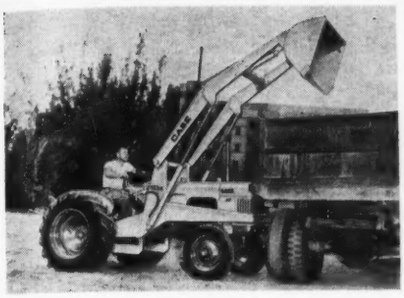
- NEW! Coinette slug-rejector coin-drop meter . . . NO knobs to turn, NO slides to push! Available with 60-Minute timer.
- Stainless steel fronts and/or sides available, or Baked-on enamel; undercoated inside and out.
- Permanent type perforated steel lint cylinder—no costly replacements.
- Gear driven transmission, 2-year warranty, NO daily maintenance.
- Electronically balanced aluminum fan, rugged heavy-duty motor.
- Plus many more outstanding features—write for FREE literature.

TC-2

Built Up to a Standard-Not Down to a Price

Cook Machinery Co., Inc.

4301 S. Fitzhugh Ave. Dallas 10, Texas



NEW ECONOMY-MODEL WHEEL-MOUNTED LOADER from J. I. Case Company has extra-high dump-and-go clearance of 8 ft 5 in. width 30-in. reach. Lifts 1000-lb bucketsful to maximum 10 ft 5 in. high in seconds. Dumps clean at 45 deg. Close-coupled 11, 13, or 18-cu ft buckets cut 5-in. below grade, roll back 17 deg for easy heaping, tilt 90 deg forward for fast backfilling and finishing. Tractor mounts 10 ft "matched" Case-built backhoe, mowers, and other tools.

CIRCLE (15) ON THE REPLY CARD

NEWLY-DESIGNED PRESSURE CONTROL DEVICE manufactured by Mercoid Corporation weighs only 1¾ lb. Its lightweight and small size — 4⅛ by 3⅛ by 2⅞ — make it particularly suitable for mounting where limited space is available or for mounting on wiring channels. Features include external adjustment, repetitive trip point, visible calibrated dial with pointer, visible hermetically-sealed mercury contact. Operates from 1 to 20 psig with a fixed differential of 0.5 psig and a maximum pressure of 30 psig.

CIRCLE (16) ON THE REPLY CARD

NEW DELAY UNITS to prevent closing of gas valves during momentary periods of voltage-drop have been introduced by Michigan Controls Company. Units keep fuel shut-off valves open for 5-second period in event of power fluctuation or failure caused by thunderstorms, power changeover, and the like. Available in 3 basic models: Model "A" operates on 440, 220 or 110-v 60-cycle current and is ideally suited for most industrial gas furnaces. Model "B" incorporates an additional interlock for use with other types of safety devices. Model "C" is designed for use with flame safety controls and permits a greater variety of combinations for maintaining external circuits.

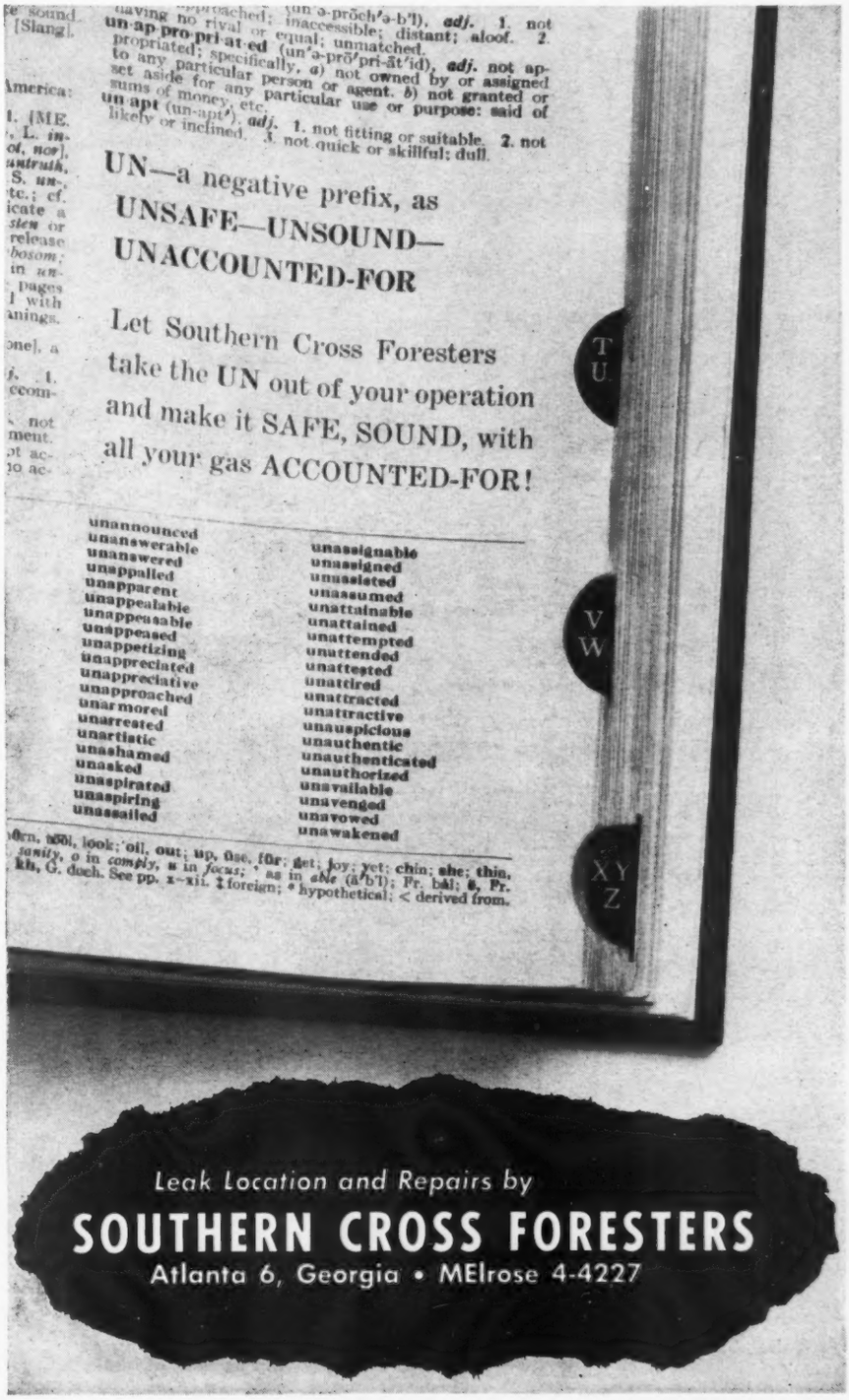
CIRCLE (17) ON THE REPLY CARD

GAS TORCHLITES for home and commercial use can be installed singly or in clusters to add a touch of glamour and romance to almost any setting. They do not require mantles and burn with a foot-high yellow flame. Two styles now available from Valley Manufacturing Company are *Classic*, a modern adaptation of an antique lamp, and the *Luau*, designed in the traditional image of the Hawaiian feast torch. Each Torchlite uses approximately 25 cu ft per hr of manufactured or natural gas, butane, or propane. Connection is the regular gas supply.

CIRCLE (18) ON THE REPLY CARD

FOR REALLY BIG LOADING JOBS in the field, newest addition to the Payloader line of rubber-tired, 4-wheel-drive tractor-shovels features the highest dumping clearance, the longest reach and the most powerful engine of any tractor shovel of its size and capacity range. Maximum height of raised bucket is 19 ft 2½-in., with bucket dumped at 50 deg, clearance under bucket edge is 10 ft 10 in. Forward reach from the front tire 3 ft 6 in. Turbo-charged Cummins diesel engine provides 300 hp at 2100 rpm. Recommended load "carry capacity" is conservatively rated at 12,000 lb. Buckets from 3 to 6 cu yards are offered for handling various materials where the total load weight falls within the "carry capacity" range.

CIRCLE (19) ON THE REPLY CARD



BOOKSHELF

1959 Registry of Industrial Radio Systems, *edited by Ethel V. Sleeper, published by Communication Engineering Book Company, Monterey, Massachusetts. Pages, 224. Price, $5.*

Lists all systems in the special gas, petroleum, industrial forest products, relay press, motion picture, power utility, and VHF maritime services including the name and address of each licensee, location of each transmitter, call letters, number of mobile units authorized, operating frequencies, manufacturer of equipment used. Second section of registry lists licensees according to transmitting frequency they employ. More than 30,000 listings.

Anniversary Celebrations Made Easy, *by John D. Peel, published by Chilton Company — Book Division, 56th and Chestnut Streets, Philadelphia 39, Pennsylvania. Pages, 318. Price, $5.*

Book is a combined manual of procedure, workbook, and sourcebook of ideas for the staging of anniversary celebrations written to help anyone charged with responsibility for setting up machinery and program for a public anniversary celebration, and exploiting the publicity and the public relations values of the observance. A "how to" book, it is designed to guide the reader in an A-B-C manner from the day the idea of a celebration is first considered to the day the final program of events is approved by everyone concerned. Ideas and suggestions are presented simply and clearly, supplemented with explanatory diagrams, charts, graphs, and forms. More than 150 actual tried-and-proved ideas for anniversary activities and events are included.

Evaluated Weather Data for Cooling Equipment Design, *published by Fluor Products Company, Whittier, California. Pages, 83. Price, $35.*

Technical manual contains all the weather data needed to design comfort and commercial air conditioning systems in the U. S. Manual is a condensed presentation of summaries resulting from the collection, tabulation, and careful evaluation of all of the summer hourly observations taken in the last 10 years at approximately 400 continental U. S. stations and a number of foreign stations. More than 10,000,000 hourly observations were processed through machine equipment at the National Weather Records Center at Asheville, North Carolina, to produce one of the most useful collection of evaluated information on wet bulb temperatures ever produced. Design values for various frequencies of wet bulb temperatures are given for each station in both table and map form. Data on dry bulb temperatures, wind speeds, and directions coincident with the high wet bulb temperatures are also included.

Identification and Determination of Organic Sulfur in Utility Gases, *by D. McA. Mason and Henry Hakewill, Jr., edited by A. E. S. Neumann. Published by the Institute of Gas Technology, 17 West 34th Street, Technology Center, Chicago 16, Illinois. Pages, 52. Price, $5.*

Methods of accurately determining the types and amounts of organic sulfur (mainly mercaptans) in utility and synthesis gases are described in IGT Research Bulletin No. 5. Methods described permit determination of concentrations of less than one grain per 100 cu ft of gas. Detailed drawings of special equipment designed for use with these methods are given in an appendix.

Oil Well Drilling Technology, *by Arthur W. McCray and Frank W. Cole, published by the University of Oklahoma Press, Norman, Oklahoma. Pages, 520, Price, $9.95.*

Provides accurate and complete information on modern drilling techniques, whether the well is 100 or 20,000 ft deep, whether it is situated on the plains of Kansas or offshore in the Gulf of Mexico. Presents thoroughgoing discussion of geological and geophysical principles governing oil and gas accumulation, coring, formation evaluation and the drilling of wells. Graphs, charts, and figures are used freely, along with illustrations of many types of equipment. Book was compiled with the assistance of the American Association of Oilwell Drilling Contractors.

National Fire Codes, 1958, Vol. 1 "Flammable Liquids and Gases," *published by National Fire Protection Association, 60 Batterymarch Street, Boston 10, Massachusetts. Pages, 896. Price, $7.*

One of six volumes of new and revised 1958 edition of National Fire Codes, Volume I gives 35 standards developed by NFPA in the fields of flammable liquids and gases. The codes are offered as a suggested basis for safety to life and property from fire without causing undue inconvenience and expense. Purely advisory so far as the NFPA is concerned, the codes are used widely in the U. S. and Canada.

Lancaster SYNTHETIC DIAPHRAGMS
UNSURPASSED
by any other material in any conditions of natural gas operations
MATERIAL DIFFERENCE
Basic material of the special Lancaster formula—Buna-N rubber—withstands roughest usage.
S-700-L SYNTHETIC DIAPHRAGMS for 1-A Sprague Gas Meters
NO FABRIC BREAKDOWN
Strength throughout! Cloth lining—the major point of failure—has been eliminated. No restrictions or leaks from fabric failure!
HIGH FLEXIBILITY . . .
LOW DIFFERENTIAL . . .
LANCASTER SYNTHETIC DIAPHRAGMS ARE REINFORCED AT ALL FLEXING AND HINGING POINTS . . .
WITHSTAND EXCESSIVE FLEXING
Use Lancaster S-700-L and S-7-L Synthetic Diaphragms with complete confidence in any natural gas operation. Not recommended for manufactured gas.
"a meter is only as accurate as its parts"
Lancaster METER PARTS CO.
Manufacturers of Quality Parts for Gas Meters
POST OFFICE BOX 378 LANCASTER, OHIO
Canadian Representative: Ontor Limited, Toronto 2, Canada

NEWSREEL

Hall of Flame of the American Gas Association has added six new members in recognition of outstanding service to the industrial and commercial gas industry with the nomination of (left to right) Robert N. Spear, manager of commercial sales for Ruud Manufacturing Company; Frank Paxton, industrial and commercial supervisor for the Gas Service Co.; Harold Massey, managing director of The Gas Appliance Manufacturers Association; Richard V. Keating, president of Keating of Chicago, Inc.; and E. V. Bowyer, sales manager for Roanoke Gas Company and (not shown) Fred H. Groen Jr., vice president of the Groen Manufacturing Co. Certificates of membership in the honorary Hall of Flame were presented the six men at a recent A.G.A. sales conference.

NEPTUNE METER COMPANY has formed a new gas meter division with Walter H. Sieger, previously president of Revere Corporation of America, as head of the new division. Sieger has also been elected president of Superior Meter Company, effective April 15. Core of Neptune's new gas meter division is Superior Meter Company with manufacturing facilities in Brooklyn, New York, and Punxsutawney, Pennsylvania. Superior, a wholly-owned Neptune subsidiary, is expected to benefit from the move by the increased use of Neptune's national marketing facilities as manufacture and sales of gas meters progress from a local to national scale.

RHEEM MANUFACTURING COMPANY and The Siegler Corporation have entered into a joint manufacturing arrangement that calls for the manufacture of Siegler's line of General water heaters at the Rheem plant in South Gate beginning after the mid-year and future production of certain added lines of Rheem heating equipment at Siegler's Pasadena plant. The new plan, worked out through combined efforts of the Holly-General Division of Siegler and the Home Products Division of Rheem, covers only manufacturing activities of both companies. Existing lines of both General and Rheem water heaters will maintain complete individual product identity and continue to be produced as presently designed. Engineering, design and tooling, and marketing, will be maintained on a completely separate basis.

ARKANSAS INDUSTRIAL PIPELINE CORPORATION of Shreveport, Louisiana, wholly-owned subsidiary of Arkansas Louisiana Gas Company, has been exempted from regulation by the Federal Power Commission under the terms of the Hinshaw Amendment of the Natural Gas Act. This brings the total to 122 companies who have been exempted either fully or partially.

KEYNOTE ADDRESS of the fourth annual Appalachian Underground Corrosion Short Course to be held at the West Virginia University, Morgantown, West Virginia, June 2-4, will be given by Dr. Hugh P. Godard, Aluminium Laboratories, Ltd., president of the National Association of Corrosion Engineers. Twenty-eight new classes dealing with underground corrosion are being offered this year, and a total of 33 new instructors will take part in the 64 basic, intermediate, and advanced corrosion classes. Among the instructors are two former presidents of the NACE—Dr. W. F. Fair, Jr., Koppers Company, Inc., and L. L. Whiteneck, Plicoflex, Inc.

SUBURBAN PROPANE GAS CORPORATION has purchased International Chemical Extinguisher Corporation, fire extinguisher manufacturer of Atlanta, Georgia, owner of exclusive manufacturing rights for the patented Keefe dry chemical fire extinguishing systems and portable extinguishers.

ARKLA AIR CONDITIONING CORPORATION, wholly-owned subsidiary of Arkansas Louisiana Gas Company, will construct this summer a $2,000,000 factory at Russellville, Arkansas. The plant will produce natural gas meters, industrial gas control devices, and a variety of gas-burning household and commercial appliances. The building, which initially will have 45,000 sq ft of floor space, will cost approximately $500,000. Tools and equipment will cost approximately $1,-500,000 A large volume of ALG's appliance research and development will be centered at Russellville.

LIVINGSTON, TENNESSEE, has received $4,000 from the Community Facilities Administration "for preliminary planning of natural gas facilities" which may result in another municipal gas system. Cost of the project to serve the community of 2900 is estimated at $413,800 with construction to begin in 1960.

THREE GAS COMPANY MEN were among seven regional winners who each received a $250 cash award in the "Pictures for Profit" contest conducted by Permaglas division of A. O. Smith Corp. Winners were W. A. Coger, Washington Natural Gas Co.; Charles A. Casey, Philadelphia Electric Co.; Charles H. Cass of The Hartford Gas Co.; J. C. Jeurink, Ward Terry and Co.; Ralph L. Henry, Gas Heat Distributors, Inc.; Don Marder, International Supply Co.; and Russ Gunther, Chicago Furnace Supply Co. Contest was to obtain case histories for effective sales promotion of commercial water heaters.

COMMERCIAL GAS AWARDS have been given by the Gas Appliance Manufacturers Association to Roanoke Gas Company Division of the Scranton-Spring Brook Water Service Company, and the Ohio Fuel Gas Company. Grand prize awards (plaques and $200 cash) to these winners, and presentations to seven utilities judged best in the three categories of the 1958 "PEP" competition were made at the recent industrial-commercial sales conference of the American Gas Association.

A. M. BYERS COMPANY, producer of 4-D wrought iron products and marketer of plastic pipe, has opened a new sales office in Richmond, Virginia, with Douglas F. Williams, a field service engineer previously assigned to the company's Boston, Massachusetts, office, in charge.

New $4,000,000 Robertshaw-Fulton plant at New Stanton, Pennsylvania, is now under construction. The plant, due for completion in mid-1960, will replace plants now operated by Robertshaw-Thermostat Division at nearby Youngwood and Scottdale. A 50 percent increase in production capacity is expected for the Division with the completion of the new plant. Consisting of a three-level office building and two manufacturing buildings, the new plant will have 265,000 sq ft of manufacturing space and 62,000 sq ft of office space.

MAKING THE BEST BETTER THAN EVER!

35-B IRONCASE METER

80-B 250-B 500-B

AMERICAN METER CO

AMERICAN®
METER COMPANY
INCORPORATED (ESTABLISHED 1836)
General Offices: Philadelphia 16, Pa.
Sales offices in principal cities

American® high capacity Ironcase Meters with

DURAMIC DIAPHRAGMS—molded, 3-convolution design for all fuel gas services.

REINFORCED FLAG RODS—insure positive alignment and sustained accuracy.

GROMMET SEALS—on flag rods provide minimum friction.

American high capacity Ironcase and Aluminumcase meters now incorporate these latest design advances for handling the big loads accurately and economically.

Sustained accuracy is built into these meters with the many refinements developed by American in over 120 years of meter engineering.

- Rated capacities to 10,000 cfh — 0.60 sp. gr. gas.
- Working pressures to 250 psi in rugged Ironcase meters . . . to 100 psi in light weight Aluminumcase meters.
- Valve motion and linkage, designed for minimum angularity effect, provides minimum wear and maintenance.
- Permanent steel inserts in connections of Aluminumcase models eliminate thread galling.
- Gas-tight, non-warping valves are light for minimum friction and noiseless for trouble-free service.

See Playhouse 90 on CBS-TV

GEM METER

SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves

DONALD C. MORGAN has been elected chairman of the gas meter and regulator division of the Gas Appliance Manufacturers Association. Morgan, assistant vice president and products manager for gas products, Rockwell Manufacturing Company, succeeds Thomas J. Watt of Sprague Meter Company who has been elected to the GAMA executive committee.

ARKANSAS LOUISIANA GAS COMPANY continues to diversify—its latest purchase is the Razorback Fiberglass Corporation of Little Rock which presently manufactures 15-ft pleasure boats. Plans for the new wholly-owned subsidiary include construction within six weeks of a $100,000 manufacturing plant east of Malvern, Arkansas. Other products will also be manufactured when operation is expanded upon completion of the new plant.

EBASCO SERVICES INCORPORATED, has become affiliated with Pacific Planning & Research, Inc., a city planning firm with offices in Sacramento and Palo Alto, California. The affiliation marks Ebasco's continued expansion in the field of community planning and will provide Pacific Planning with additional resources in related fields. The new affiliate offers services in city and regional planning, urban renewal, urban economics, and natural resource planning to more than 50 cities, counties and special districts in California as well as to prominent industrial clients. Both the Palo Alto and Sacramento offices will be maintained, and the Pacific Planning staff of each will work in conjunction with Ebasco's San Francisco staff.

GAS UNITY COMMITTEE for 1959 — a 14-man group headed by Gordon M. Jones, sales manager of the United Gas Improvement Co. — will work on problems common to gas utility companies, liquefied petroleum gas suppliers, and gas appliance and equipment manufacturers. Interests of the committee have been expanded during the past few months, and now include a wide range of sales building, product development, and fuel utilization subjects of mutual interest to the three major sections of the gas industry. Committee members are: H. Leigh Whitelaw, executive vice president of the Gas Appliance Manufacturers Association; Howard D. White, executive vice president of LPGA; W. R. Sidenfaden, president of Suburban Gas Service, Inc.; C. J. McAllister, president of Parlett Gas Co.; J. Woodward Martin, assistant sales manager of the Shamrock Oil and Gas Co.; George J. Schulte, Jr., director of the National LP-Gas Council; Glen McGuire, vice president of Union LP-Gas Co.; C. S. Stackpole, managing director of A.G.A.; Fred H. Faulstich, vice president of Springfield Gas Light Co.; and Jerome P. Happ, vice president-sales, North Shore Gas Co. Three ex-officio members are: Arthur E. Bone, president of LPGA and vice president of the Eastern Propane Co.; J. Theodore Wolfe, president of A.G.A. and Baltimore Gas and Electric Co.; and Clifford V. Coons, president of GAMA and executive vice president of Rheem Manufacturing Co.

WILLIAM F. LOWE, executive director of the Natural Gasoline Association of America, received the Hanlon Award, highest honor in the natural gasoline industry and one of the ranking awards in the petroleum industry, at the 38th annual convention of the NGAA held recently in Dallas.

MASSEY-FERGUSON, LTD. of Toronto has successfully bid to purchase a controlling interest — 5,200,000 ordinary shares — of F. Perkins, Ltd., Peterborough, England, one of the world's foremost diesel engine manufacturing companies. Purchase of Perkins' diesel engine facilities will increase the strength and integration of M-F's manufacturing operations, and is in line with an increasing trend in North America toward diesel-powered farm and industrial machinery, due to inexpensive fuel, better performance in high altitudes, and other factors.

TAYLOR FORGE & PIPE WORKS of Chicago has acquired the Paola, Kansas, metal manufacturing facilities of Fluor Products Company, a division of The Fluor Corporation. Terms of the transaction were not disclosed. Taylor Forge assumed operation of the five-acre plant early in March. Sale included all fixed assets, including machinery, tools and equipment. In addition, Fluor assigned two patents on extruded metal parts to Taylor Forge and gave the new owners a non-exclusive license to use about 50 U. S. and foreign patents related to the business. Fluor product engineering and purchasing operations at Mission, Kansas, were also included in the transaction. But, Fluor retains its Paola construction equipment yard as well as the Hartmann division, manufacturer of pneumatic conveying and unloading equipment, with offices in Mission.

DECOMPOSING WATER WITH LIGHT — A method for decomposing water into its two gaseous elements by means of a beam of light has been discovered by two New York University scientists, Dr. Hartmut Kallman, professor of physics, and Dr. Martin Pope, research scientist at the University's Institute of Mathematical Sciences. Their work apparently confirms certain theories dealing with photosynthesis and is seen as useful in future studies concerning solar energy applications important to the gas industry as a "future" fuel. *(See "The Century Ahead" page 23, Jan. 1959 AGJ.)* The method, developed in the course of basic research into electrical properties of certain organic crystals, utilizes equipment similar to a solar battery, but involves use of artificial ultraviolet light rather than sunlight. The organic crystal used is anthracene, an inexpensive chemical related to the moth ball.

INITIAL PLANS for the 19th Annual Appalachian Gas Measurement Short Course to be held August 24-26 at West Virginia University, Morgantown, West Virginia, have been completed. The intensive three-day course will cover fundamentals of gas measurement, with special sessions on domestic meters, orifice meters, large capacity meters, automatic control instruments, pressure regulators and other related equipment. Basic courses will be offered for those new in the industry, and monitored open forum discussions and actual demonstration classes in the application and servicing of gas equipment will be offered daily.

ELIMINATE MAJOR REPAIRS

WITH

AMERICAN® WELDED STEELCASE METERS

- Tinned Steelcase Accuracy
- Hardcase Durability
- Maintenance Economies

American Welded Steelcase Meters provide a new approach to the economics of meter maintenance and retirement. Major repairs are eliminated. Minor adjustments are easy to make – assuring long service life at lowest maintenance costs.

Ask your American Meter representative for full details about Welded Steelcase Meters and their many advantages for all fuel gas services.

W-75	Rated cap. 75cfh — FOB Philadelphia
W-175	Rated cap. 175cfh — FOB Fullerton, Cal.
W-210	Rated cap. 210cfh — FOB Philadelphia
W-250	Rated cap. 250cfh — FOB Philadelphia
W-300	Rated cap. 300cfh — FOB Philadelphia
W-45-LPG	Rated cap. 45cfh* — FOB Philadelphia
WC-45-LPG	Rated cap. 45cfh* — FOB Philadelphia

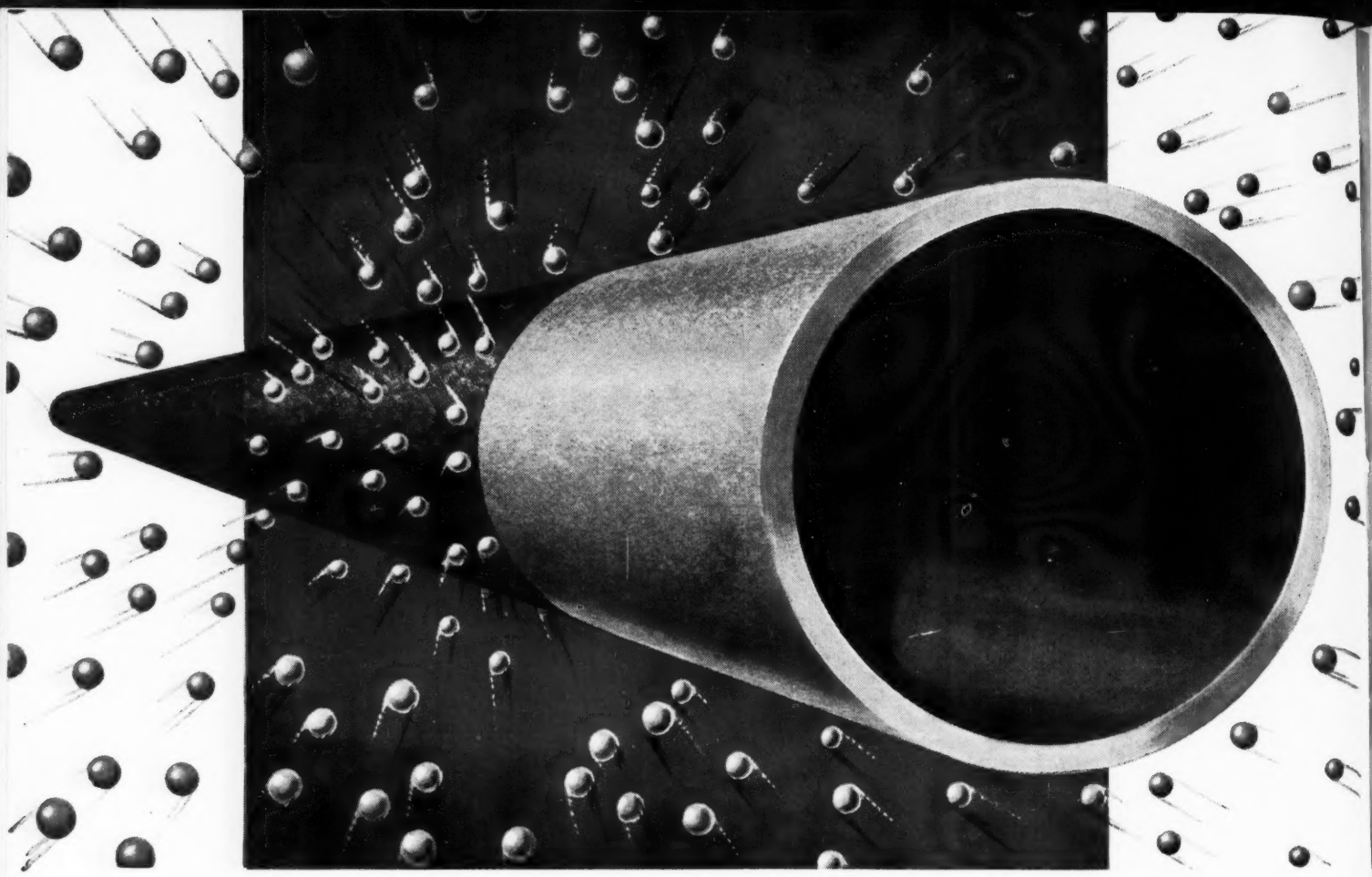
*propane

Rated capacities at ½-inch w.c. differential with 0.64 sp. gr. gas — 5 psi working pressure.

AMERICAN® METER COMPANY
INCORPORATED (ESTABLISHED 1836)

General Offices: Philadelphia 16, Pa.

Sales offices in principal cities



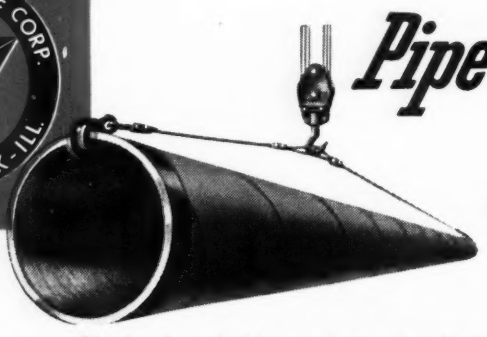
Steel Shot Cleaning makes Pipe Protection Stay Put

Applying protective coatings to improperly prepared pipe surface makes about as much sense as building a skyscraper on sand. Pipe Line Service has always pioneered in developing new ways to insure a good bond . . . a bond that makes protective coatings practically inseparable from the pipe itself.

An outstanding example is steel shot cleaning. Special machines permit bombardment of the pipe surface with millions of steel pellets traveling at high speed. Result? Not simply removal of mill scale and rust . . . but actually an "etching" of the steel surface. This slightly roughened surface allows the protective coating to "take root"—gives you the years of protection that you should have.

We emphasize Pipe Line's steel shot cleaning process because it was one of the great steps forward in maximum protection of *your* pipe investment. It's a manufacturing extra that's provided at no extra cost . . . and one more reason for extra confidence in specifying protection by PLS!

PIPE LINE SERVICE CORP. SERVICE EQUIPMENT MATERIALS FRANKLIN PARK - ILL.



Pipe Line Service Corporation

General Offices and Plant: Franklin Park, Ill.

Quality pioneers in coating and wrapping pipe for over a quarter century

A Subsidiary of American Steel Foundries

Plants also at: Monmouth Junction, N. J.; Glenwillard, Pa.; Sparrows Point, Md.; Longview, Tex.; Corpus Christi, Tex.; Provo, Utah; Harvey, La.

Sales offices at all plant locations . . . and Atlanta, Ga.; Dallas, Tex.; Houston, Tex.; Lincoln, Nebr.; Syracuse, N. Y.

ADVERTISERS INDEX

American Liquid Gas Corporation.. 36
American Meter Company....46, 52, 53
American Meter Company, Reliance Regulator Division..... 5
Arkla Air Conditioning Corporation. —
Auburn Machine Works..... —
Barber-Greene Company ..... —
Bryant Manufacturing Company.... 37
Chaplin-Fulton Manufacturing Company 2
Cleveland Trencher Company, Inc... 40
Comfort Products, Inc..... —
Cook Machinery Company..... 48
Dearborn Chemical Company..... 45
Dearborn Stove Company..... —
Deere & Company....Inside Back Cover
Dollinger Corporation ..... —
Dresser Industries, Inc..... —
Dresser Manufacturing Division.... —
Eclipse Fuel Engineering Co..... —
El Paso Natural Gas Co..... 35
Fisher Governor Company 10, 11
Fisher Research Laboratory, Inc..... 14
Greenlee Tool Company..... —
Hays Manufacturing Company..... —
H & M Pipe Beveling Machine Company ..... —
Frank G. Hough, The, Company.... —
Johns-Manville ..... —
Kimray, Inc. ..... —
Lancaster Meter Parts Co..... 50
Lone Star Steel Company..... 17
Massey-Ferguson Industrial Division, M-H-F, Inc. ..... —
May Products Inc..... —
Mercoid Corporation 33
Midwestern Pipeline Products..... 70
Mueller Co. 6, 7
Nibco, Inc. ..... —
Norton-McMurray Manufacturing Company 48
Norwalk Valves ..... —
Oronite Chemical Company ..... —
Pipe Line Service Corporation 54
Pittsburgh Coke & Chemical Company, Protective Coatings Division..... —
Professional Directory 36
Reynolds Gas Regulator Company.. 16
Robertshaw-Fulton Controls Co. ... 8-9
Rockwell Manufacturing Company, Products Division ..... —
Rockwell Manufacturing Company, Nordstrom Valve Division.....Inside Front Cover
Safety Gas Main Stopper Co., Inc... 14
Sheehan Pipeline Construction Co... —
Sherman Products, Inc..... —
Skinner, M. B., Company 13
Somerville Construction Co. ..... —
Southern Cross Foresters 49
Southern Pipe Coating Co. ..... —
Sprague Meter Company, The ..... Back Cover
Standard Pipeprotection, Inc..... 15
Superior Meter Company..... 12
Tapecoat Company 4
Tinker & Rasor..... 48
Universal Controls Corporation .... —
William Wallace Company..... —
Wilkinson Products Company..... —

THIS INDEX IS PROVIDED AS AN ADDITIONAL SERVICE FOR OUR READERS — THE PUBLISHER ASSUMES NO RESPONSIBILITY FOR ERRORS OR OMISSIONS

Newly elected officers of the Indiana Gas Association are (left to right): 1st vice president, C. D. Rees, Northern Indiana Public Service Company; president, E. E. Ihlstrom, Richmond Gas Corporation; and secretary-treasurer, R. A. Steele, Citizens Gas & Coke Utility. Not shown is G. R. Woehler, Southern Indiana Gas & Electric Company, who was elected 2nd vice president.

THREE COMPANIES have been newly elected to membership in the Gas Appliance Manufacturers Association. The Airtemp Division of Chrysler Corporation has been elected to the gas furnace division; The Flynn Burner Company and Protection Controls, Inc. have been elected to the industrial gas equipment division.

WALWORTH COMPANY has recently completed negotiations with Midwest Piping Company, Inc. for the manufacture of Walworth welding fittings, including complete lines of elbows, reducers, tees, caps, laterals, etc. All products comply with ASTM, ASA, ASME, and government requirements. The Midwest welding fittings complement Walworth's present lines of cast and malleable fittings and will be sold nationally through company's offices and distributors.

READING BODY WORKS, INC. has appointed eight new distributors to handle its line of "job-planned" service, utility, and line construction truck bodies. They are: Farm Equipment Co., Erie, Pa.; Machine and Welding Co., Dunn, N. C.; Seguin Truck Body Builders, New Bedford, Mass.; Stewart Equipment Co., Charleston, W. Va.; Texas Hydraulic and Equipment Co. Inc., Dallas, Texas; Truck Equipment Headquarters, Washington, D. C.; Warner Fruehauf Trailer Co. Inc., Baltimore, Md., and Weaver Trailer and Body Co. of Columbus, Ohio.

RIDGE TOOL COMPANY has added two new "Mobile Demonstration Wagons" to its fleet of four pipe tool demonstration wagons. John R. Wall will cover the southeastern states of Florida, Georgia, Alabama, Mississippi, Tennessee, and South Carolina with one wagon. Ronald W. Ifould will cover Quebec and the maritime provinces with another of the special demonstration wagons that are especially equipped with a portable generator that allows the demonstration of Ridgid pipe and bolt threading machines and power drives.

Correction

Acknowledgment for the article on "Storage, Handling and Use of Plastic Pipe" by H. E. Wade that appeared in the May 1959 issue of AMERICAN GAS JOURNAL should read: *This article adapted from a presentation made at the 1959 A.G.A. General Management Conference.*"

THE NEWLY-FORMED GRIFFIN PIPE DIVISION, Griffin Wheel Company, plans to construct a cast iron pressure pipe foundry at Council Bluffs, Iowa, this year to manufacture cast iron pressure pipe in sizes 4 through 12-in. inclusive in 20 ft lengths by the Delavaud process. Construction activities will start at once and are scheduled for completion by end of 1959.

BROOKLYN UNION GAS COMPANY replaced approximately 148,500 meters in 1958 in accordance with a ruling of the Public Service Commission of the State of New York providing that no gas meters shall be continued in service untested for a period exceeding seven years. The 1958 program of meter replacement represented an increase of 18 percent or 22,800 meters over 1957's periodic meter change figure of 125,700. Approximately 95 percent of the meters changed were five-light meters, capable of measuring 150 cu ft of gas an hour. However over 7700 ten-light or larger meters were also changed last year the the gas distributed since Brooklyn Union's conversion has twice the heating value of that sent out previously, and these large meters are no longer needed. Iron case meters were installed in situations involving higher gas pressures.

THREE COURSES IN NATURAL GAS TECHNOLOGY will be offered this summer at the Institute of Gas Technology, Illinois Institute of Technology. The natural gas distribution course offered from July 6 through July 24, will cover design, construction, and maintenance of distribution systems. The natural gas fuel utilization course from July 20 to August 7 will be broken down into three phases: Fundamental theory of combustion process, problems related to combustion systems, and applications relating to domestic and industrial use of gas as a fuel. Also scheduled is a session on natural gas transmission from June 15 to July 3 that will discuss behavior of gas and methods of transmission.

GAS SUPERINTENDENT WANTED

Natural gas distribution company in Pennsylvania needs competent superintendent to direct gas distribution, sales and service. Approximately 4,000 meters. A growing business in an attractive community. Reply stating age, education, experience and salary range. Box 208, American Gas Journal, P. O. Box 1589, Dallas, Texas.

BULLETIN BOARD

CATALOGS—BROCHURES—TECHNICAL DATA

SPARKS ASTRAY is new National Fire Protection Association folder designed to forcefully point out to the welder that a fire from his torch or arc can cause him injury or even cost his life, throw scores of plant employees out of work, and destroy property worth millions. Four fire sources are listed with a graphic portrayal of danger spots — explosive mixtures of flammable gases; vapors and dust; fire tempters such as oily waste, cracks and openings through which sparks may reach combustibles, and places where sparks or hot metal may lodge to smolder unnoticed.

CIRCLE (61) ON THE REPLY CARD

CATALOG OF WARNING SIGNS for all gas industry needs is now available from California Metal Enameling Company. Profusely illustrated in color, catalog includes 65 danger worded signs, 16 caution signs, and 62 miscellaneous warning signs, in sizes ranging from 3 by 10-in. to 40 by 30-in. and from 22 to 18 gage, depending on sign size. Special section on reflectorized stock traffic signs is included along with prices.

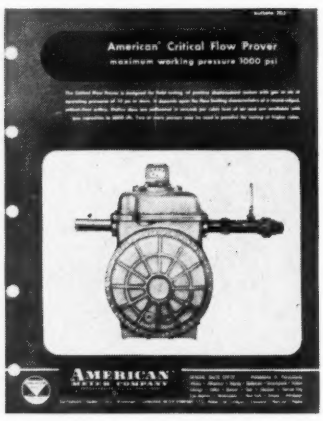
CIRCLE (62) ON THE REPLY CARD

FIRE EXTINGUISHER GUIDE is subject of new six-page folder now available from Ansul Chemical Company. Characteristics of various types of fire extinguishers are compared in tabular form. Bar graph on the last page shows comparative effectiveness of extinguishing agents according to Underwriters' Laboratory ratings. Cut-away drawings of a dry chemical extinguisher and a stored pressure water extinguisher are included.

CIRCLE (63) ON THE REPLY CARD

J. I. CASE COMPANY'S economy-model 210 utility backhoe-loader and 210 loader units are described in new 2-color bulletins now available. Operating advantages and specifications of the 34-hp, one hundred percent Case-built machines are given. Details on the heavy duty 10-ft backhoe that reaches over 15 ft and digs 14 ft of 4-ft-deep trench without moving and information on the 1000-lb capacity loader are also included.

CIRCLE (64) ON THE REPLY CARD

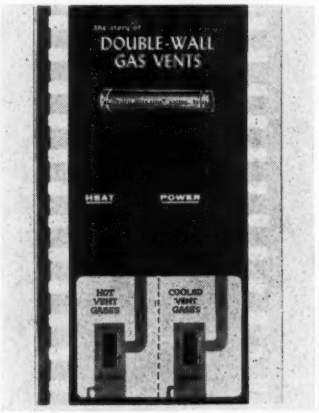


NEW CRITICAL FLOW PROVER is described in a bulletin now available from American Meter Company. Full information on the new 1000 psi model critical flow prover and its use in field testing of positive displacement meters with gas or air at operating pressures of 15 psi or more is given.

CIRCLE (65) ON THE REPLY CARD

CONDENSED CATALOG of materials handling equipment, and portable construction tools is now available from Syntron Company. The 68-page catalog presents descriptions, data, and specifications on all Syntron products including parts handling equipment, rectifier units, paving breakers, rock drills and flow control valves.

CIRCLE (66) ON THE REPLY CARD



NEW SOUND STRIPFILM on gas appliance venting, "The Story of Double-Wall Gas Vents," covers the evolution of venting from cave-man days through modern times. Theory, principle, and importance of proper gas venting is explained clearly and simply. Is available for use by gas utility training groups, and plumbing and heating association meetings from AmeriVent Division-American Metal Products Company, Inc.

CIRCLE (67) ON THE REPLY CARD

NEW GUIDE ON "HOW TO SELECT A BOILER" for industrial and commercial applications, now available from Cleaver-Brooks, covers such topics as first cost versus operating costs, selecting the right fuel, how to save on construction costs, how to solve lowhead room problem, packaged boiler versus the built-up boiler, boiler design standards, burner efficiency, and other subjects. The 20-page booklet in 5 by 7¼ in. format includes 30 illustrations and graphs.

CIRCLE (68) ON THE REPLY CARD

REVISED CATALOG of Lefax pocket size technical data books is now available. The data books sell for $1.25 each and contain about 140 loose leaf pages of up-to-date engineering material. Data books cover every field of engineering; partial list of book titles are: Automatic Engineering, Diesel Engineering, Steam Engineering, Hydraulics, A-C Motors and Generators; Electricians' Data, Electricity AC; Electricity DC, General Math, and Conversion Tables.

CIRCLE (69) ON THE REPLY CARD

NEW COOKBOOK especially produced for the newest gas range features is now available to gas distribution companies to help sell the wonders of gas. "Your Guide To an Exciting New Range of Features" gives useful information to enable women to get full use and satisfaction from their automatic gas ranges, features recipes that create consumer desire for new automatic range features. Quantity discounts on 50-cent price of book and price list of imprinting available on request.

CIRCLE (70) ON THE REPLY CARD

SAFETY PAMPHLET with common sense pointers for safe and efficient use of gas and gas appliances is now available from the American Gas Association under the PAR Public Information Program. An up-to-date version of a similar pamphlet produced in 1956, "Nine Tips on Enjoying Modern Gas Service" notes that more than 100 million gas appliances are being used by approximately 38 million American families and that gas causes fewer building fires than other widely used fuels. Pamphlet is designed for company reading racks, and for mailing to gas company employees, customers and dealers. Pamphlets cost 3 cents each; price schedules for quantities of more than 10,000 are available on request.

CIRCLE (71) ON THE REPLY CARD

DOLLINGER'S FILTERS are described in a newly-released 4-page bulletin. The 2-color bulletin shows liquid, intake and pipeline filters plus the dry and viscous panel filters, the new Duphase, the precipitators, and electro-staynew mist collector. Newest products from Dollinger research laboratories are also shown — the special silencer filter, the special pipeline filter to handle high-pressure gas, and the standard hydraulic sump filter.

CIRCLE (72) ON THE REPLY CARD

PORTABLE MOISTURE MONITORS made by Consolidated Electrodynamics Corporation are described in new illustrated 8-page brochure. Application, features, operating characteristics, specifications and other details are given. Two types of monitors are available — one with a range of 1 to 1000 parts per million, the other operates in a range from 1 to 20,000 parts per million.

CIRCLE (73) ON THE REPLY CARD

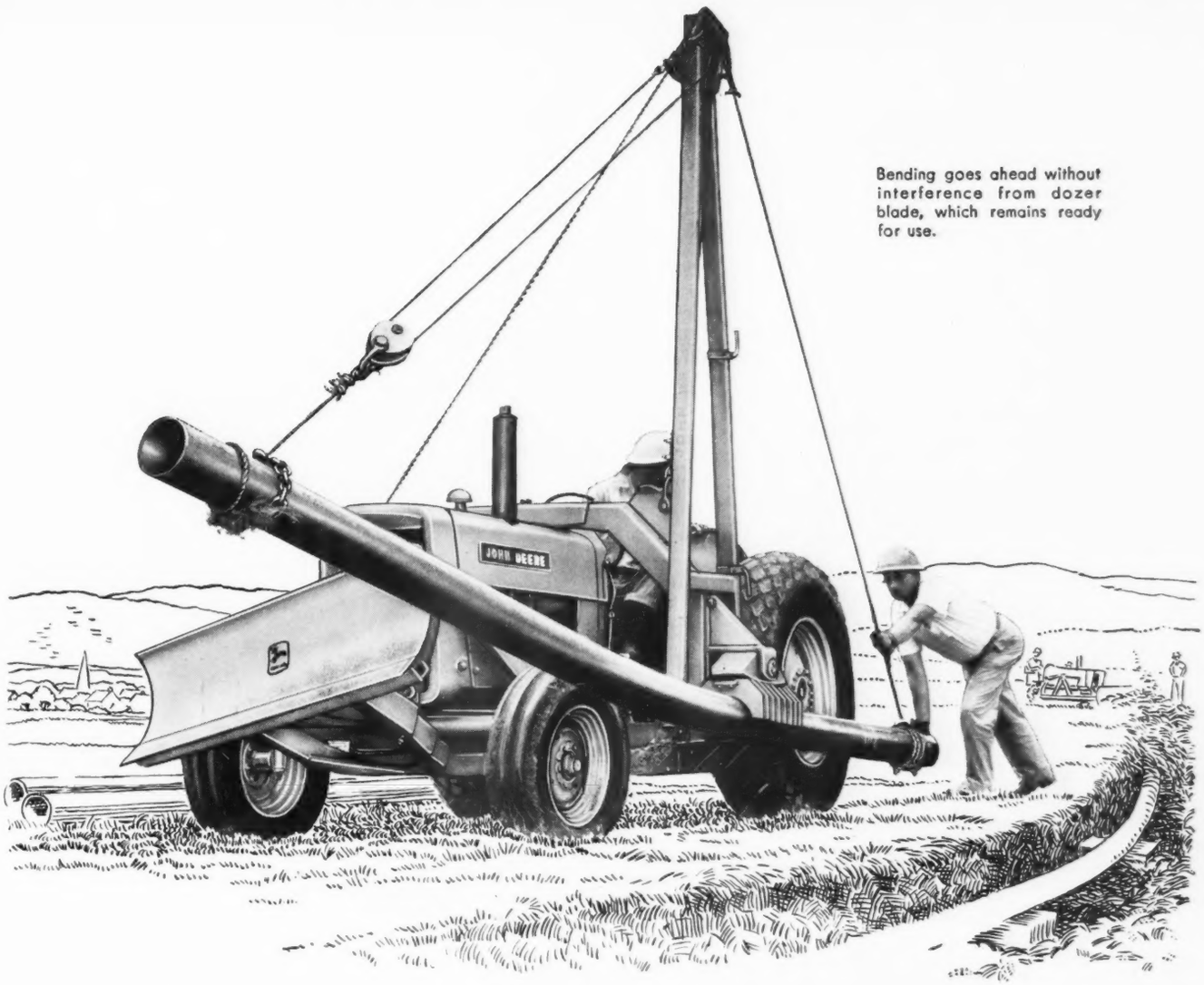
NEW ONE-MAN TRENCHER, the Arps Trench-Devil, is described in an illustrated 6-page bulletin. Self propelled, the unit features hydraulic clutch, digs trenches 2¾ to 8-in. wide, up to 54-in. deep at speeds to 1200 ft per hour in either direction. Reversible rubber-belted conveyor deposits dirt to either side.

CIRCLE (74) ON THE REPLY CARD

CASH-ACME
RELIEF VALVES and SAFETY DEVICES
PRESSURE REGULATORS and PROTECTIVE EQUIPMENT
HYDRONIC HEATING VALVES and CONTROLS

NEW AUTOMATIC VALVE WALL CHART now available from A. W. Cash Valve Manufacturing Corporation features ready reference data on company's line of hydronic heating controls, relief valves, pressure regulators and safety devices. Chart is produced the same size as a standard file folder and scored for easy folding. Opens to full 12 by 18-in.

CIRCLE (75) ON THE REPLY CARD



Bending goes ahead without interference from dozer blade, which remains ready for use.

BEND PIPE...STRETCH DOLLARS

with this JOHN DEERE *Blade and Sideboom* Outfit!

The John Deere 300 Sideboom with Pipe Bender and 301 Bulldozer Blade:

Rated Lift Capacity, 4 ft. from boom pivot, 3000 lbs.

Pipe Bender Capacity: 2-, 3-, 4-, 6-, or 8-inch pipe.

Bulldozer Blade Width, 78 inches; Lift, 22 inches.

From the day the trench is opened, to the minute the backfill is in, this versatile John Deere Sideboom outfit works any gas distribution job. Not only handles a good variety of work itself, but steps right into spots too tight for many bigger outfits.

Wherever you use this John Deere "440"—in congested city work, or on those long feeder runs in new neighborhoods, you'll save with its fuel economy, simple maintenance requirements and the extra strength that's built into every part. Both wheel and crawler models are available, and you can select these with either gasoline or Diesel power.

See your John Deere Industrial Dealer about specifications and prices.

John Deere Industrial Division Dept. 545, Moline, Illinois

JOHN DEERE

"Specialists in Low-Cost Power with a Heavyweight Punch"

BE SURE YOUR METERS ARE BEST IN

Appearance

No. 240

BE SURE TO SPECIFY Sprague

Please your customers with a gas meter that measures up in *looks* as well as in performance. The well-proportioned case, clean-line design, and solid construction of all Sprague Meters looks good anywhere, inside the house or outside. And it's especially important now, with outdoor installations becoming more and more popular, that your meters compliment you and the houses they serve.

You can count on Sprague Meters to *stay* looking good for years, too! They're too tough to dent or corrode, and their practical, honest design has no fadish "gimmicks" that will quickly go out of style. For appearance sake, choose the hard-case meter that's easy on the eyes — choose Sprague.

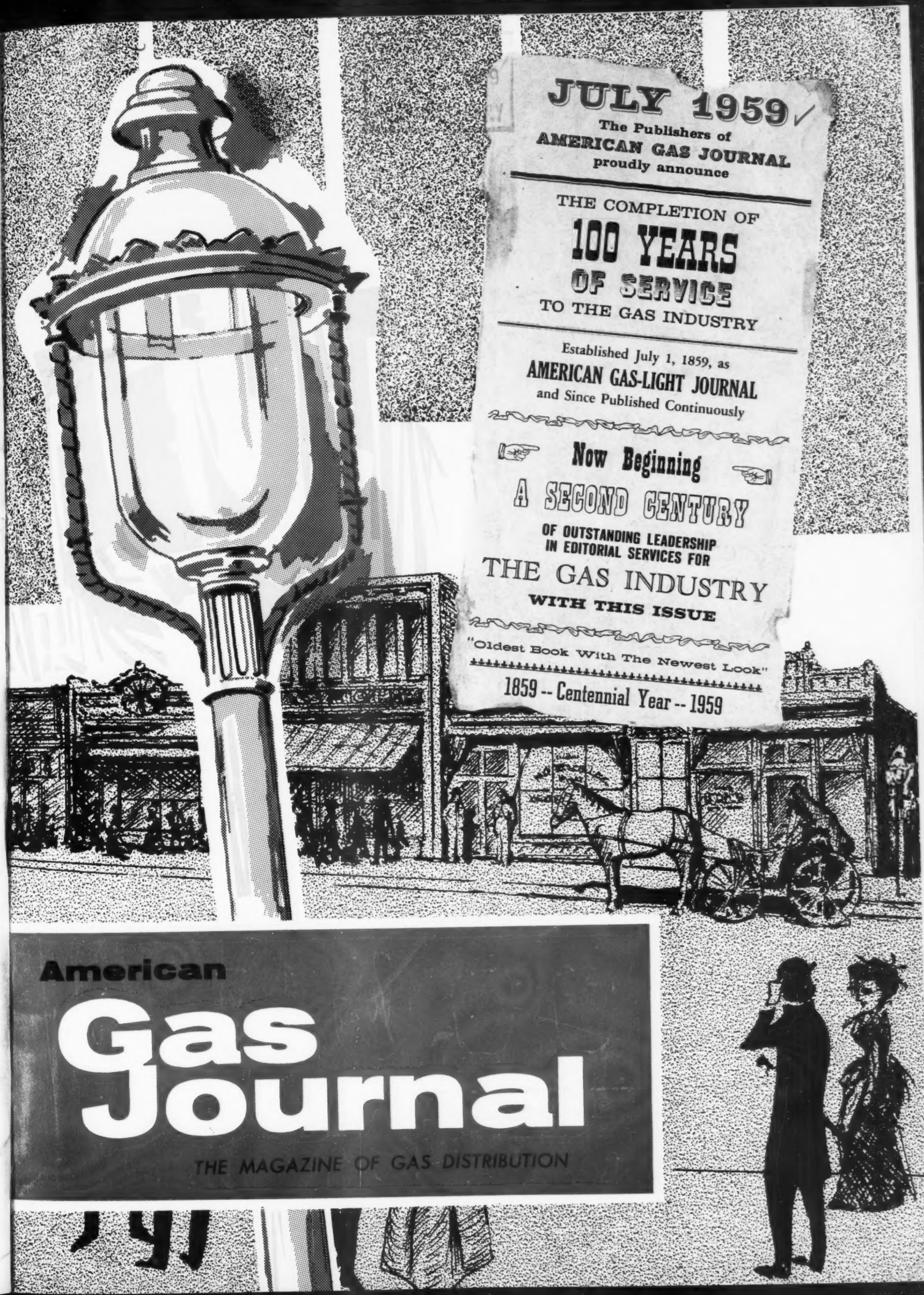
The Sprague No. 240 Meter is designed for the increased loads in domestic heating and small industrial installations. It is adaptable to both low and intermediate pressure measurement and gives outstanding service under the most exacting conditions. Like all Sprague Meters, the 240 is good looking, rugged, and famous for sustained accuracy of measurement with low maintenance costs.
Other sizes from 175 to 1,000 cu. ft. Iron Case or Aluminum Case. (Synthetic or leather diaphragms in sizes 175 & 240.)

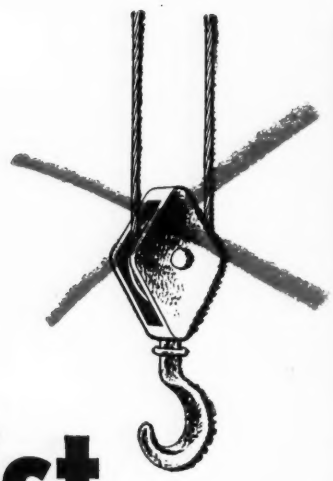
GEM

Sponsor of
"PLAYHOUSE 90"
on CBS-TV

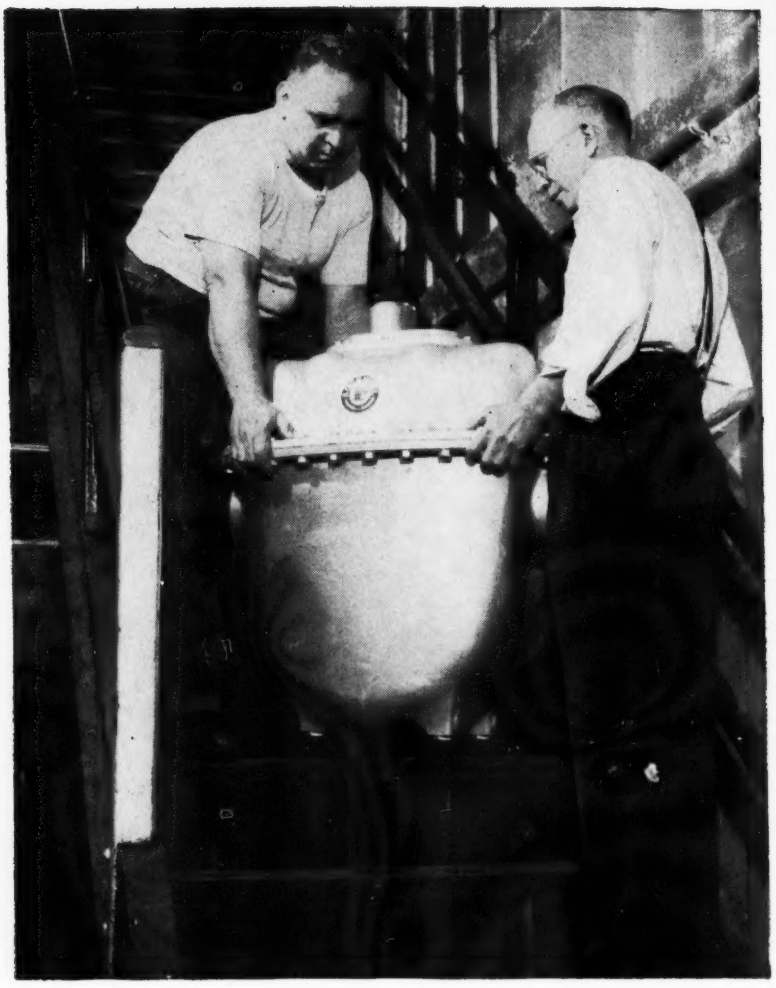
THE Sprague METER COMPANY • BRIDGEPORT 1, CONN.

WESTERN BRANCH — LOS ANGELES 23, CALIF. REGIONAL OFFICES — DAVENPORT, IOWA • HOUSTON 3, TEXAS • SAN FRANCISCO 11, CALIF.


JULY 1959
The Publishers of
AMERICAN GAS JOURNAL
proudly announce
THE COMPLETION OF
100 YEARS
OF SERVICE
TO THE GAS INDUSTRY
Established July 1, 1859, as
AMERICAN GAS-LIGHT JOURNAL
and Since Published Continuously
Now Beginning
A SECOND CENTURY
OF OUTSTANDING LEADERSHIP
IN EDITORIAL SERVICES FOR
THE GAS INDUSTRY
WITH THIS ISSUE
"Oldest Book With The Newest Look"
1859 -- Centennial Year -- 1959
American
Gas
Journal
THE MAGAZINE OF GAS DISTRIBUTION



No Hoist Needed!



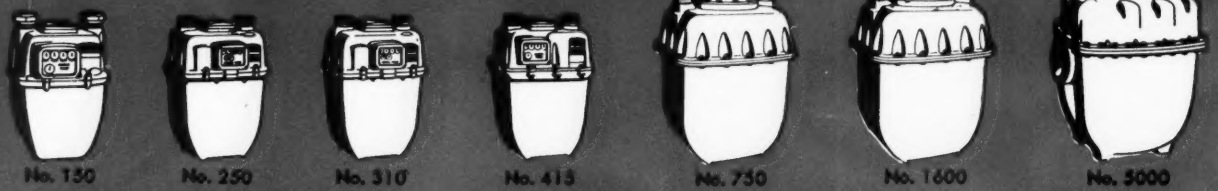
Two Men Can Easily Carry And Install

ROCKWELL "5000"

Single Joint ALUMINUM GAS METERS

WEIGHT: only 176 lb. CAPACITY: 5000 cfh at 2" diff. WORKING PRESSURE: 100 psi

Here's a 5000 cubic foot capacity "hard case" meter your men can carry with ease. It weighs only 176 lbs. as against 530 lbs. for an iron meter of like rating. Actually the Rockwell "5000" weighs little more than a big tin meter. But with it you get the safety of single joint construction—the impact and corrosion-resistance of a strong aluminum alloy case. And this meter is rated at 100 psi working pressure. Write for details, Rockwell Manufacturing Co., Pittsburgh 8, Pa.



ALUMINUM GAS METERS

another fine product by

ROCKWELL

The only complete line of ALUMINUM METERS

INDIANAPOLIS
JUL 7 1959
PUBLIC LIBRARY

1859 1959
CENTENNIAL YEAR

American Gas Journal

ONLY MAGAZINE EDITED EXCLUSIVELY FOR THE GAS DISTRIBUTION INDUSTRY

Volume 186 July 1959 Number 7

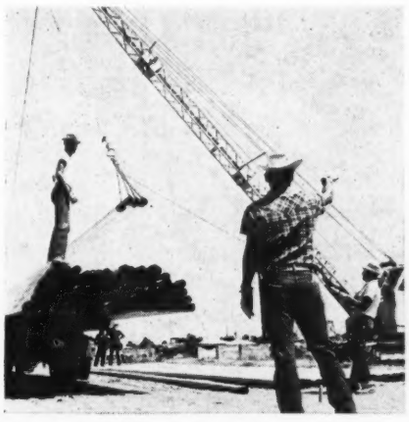
PILOT.. ..LIGHTS

On Our Way

There's nothing like starting anew . . . which is what we're doing with this issue of American Gas Journal . . . starting a new century of service to the gas industry. *"Oldest Book with the Newest Look,"* AGJ is not only the oldest publication serving the gas industry (100 years of continuous publication) but is also one of the oldest business publications in the U. S. (We've only heard of three or four others that outdate us.)

Symbolizing the end of one era and the beginning of another, this month's cover portrays the "Gas Light Era" when our publication was founded, and in the type faces of an age gone but not forgotten, proudly announce an achievement rare in the annals of businesspaper publishing. July, of course, marks the mid-point in our centennial year, which will be climaxed by a special *100th Anniversary Issue* in October.

*



Horsepower and Yellow "Pencils"

Deep in the heart of Arizona, construction crews of Arizona Public Service are busy burying long yellow "pencils" of plastic coated pipe that will bring a new type of service . . . and a new concept in selling energy . . . to the gas distribution industry. In the rich agricultural areas of the state, where irrigation farming has made a Garden of Eden out of once desert country, Public Service is making it easier for the irrigation farmer by providing "horsepower" in the form of gas-fueled engines to drive irrigation pumps. The farmer pays only for the "horsepower" used . . . and the company provides everything else. It's a revolutionary idea . . . and described fully in this issue.

IN THIS ISSUE . . .

LOAD BUILDING

Now — Horsepower for Sale 14
Arizona Public Service introduces new concept in sale of energy

Gas Turbines for Air Conditioning 20
"Total" energy conversion concept makes turbine cycle most efficient available to the gas industry; ideal for large-scale commercial and industrial A/C installations

OPERATIONS & MANAGEMENT

Theory and Operation of the A.G.A. Light Scattering Photometer 27
Part 4 in this important series on Dust in Gas Streams

'Free Power' From Flowing Gas Streams Provided by Steam Engine Used As Valve 31
Steam engine used as a pressure reducing device between high pressure and low pressure lines develops 60 hp, provides new source of power

Alsatian Dog Detects Gas Leaks 32
In Holland, trained dogs successfully detect gas leaks in city's gas mains

Coal Mine To Store Gas 34
Public Service Company of Colorado studies feasibility of converting abandoned Colorado coal mine to a storage vault for natural gas

CONSTRUCTION

Plastic-Coated Pipe Adds Color to Vast Gas Engine Program Construction 16

Hydrostatic Testing and Purging of Distribution Lines 17
Southern California Gas uses simplified procedures, improved equipment on distribution line tests

Ideas At Work:
Portable Sandblaster Cleans Mains in Service; Blade Speeds Gas Line Trench Excavating 26

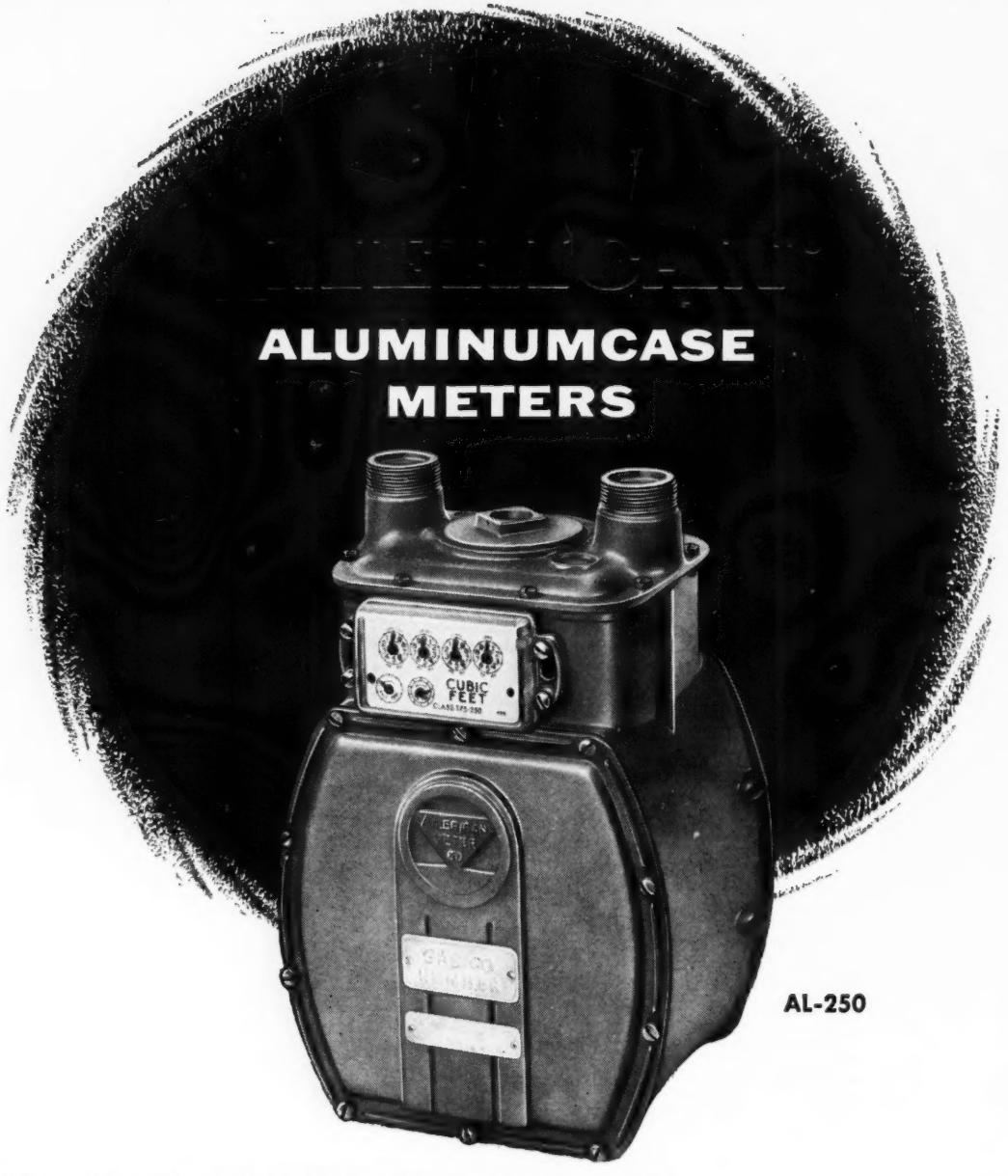
Distribution Developments 38
News about current distribution construction projects

FEATURES & DEPARTMENTS

MCF — News Hilites: *FPC's Connole presses "national energy policy" hoax* 3
Calendar of Coming Events in the Gas Distribution Industry 6
Men At Work: *News about people you know* 10
Newsreel: *135,000 new gas-heated homes due this winter* 36
Professional Directory: *Guide to engineering and consulting services* . . . 42
Product Parade: *New instrument drive and timing unit is gas-powered* . . . 43
Bulletin Board: *Free information on new equipment developments* 48
Bookshelf: *Revised NFPA Inspection manual is comprehensive safety guide* 48
Advertisers' Index: *Your guide to suppliers of quality products* 47

AMERICAN GAS JOURNAL is a registered trademark. Entire contents of this issue copyrighted. Reproduction of any part without permission of copyright owner is strictly prohibited.

ALUMINUMCASE METERS



AL-250

- Light weight reduces shipping, handling and setting costs.
- One-piece aluminum alloy pressure die-cast body... 5 psi working pressure.
- Molded, 3-convolution Duramic diaphragms for all fuel gas services.
- Modern design and attractive appearance insures customer acceptance.

5B-225

American AL-250 Aluminumcase meter, rated at 250 cfh, operates at only 7 revolutions per cubic foot for sustained accuracy through greater power and slow-speed operation. Ideal for home heating and small commercial loads.

American 5B-225 Aluminumcase meter, rated at 225 cfh, operates at the conventional nine revolutions per cubic foot and is comparable with the standard 5B Ironcase meter... for most domestic services.

GEM *See Playhouse 90 on CBS-TV. Consult local listings for time and station.*

AMERICAN® METER COMPANY

INCORPORATED (ESTABLISHED 1836)

AMERICAN METER CO EST 1836 MEASUREMENT ENGINEERS

GENERAL SALES OFFICE: Philadelphia 16, Penna. • Albany • Alhambra • Atlanta • Baltimore • Birmingham • Boston • Chicago • Dallas • Denver • Erie • Houston • Kansas City • Los Angeles • Minneapolis New York • Omaha • Pittsburgh • San Francisco • Seattle • Tulsa • Wynnewood • IN CANADA: Canadian Meter Company, Ltd., Milton, Ontario • Calgary • Edmonton • Montreal • Regina • Vancouver

SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase, and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves

AMERICAN GAS JOURNAL
1859 1959

Dean Hale
Editor
Pat Loar
Assistant Editor
Ernestine Adams
Economics and Management Editor
Jan Craig
Editorial Production Manager
Donald D. Fickert
Presentation Editor
Lynn Patton
Editorial Assistant
Cecile Pincus
Editorial Assistant

•

Joe B. Woods
President and Publisher
Abbott Sparks
Vice President and Advertising Director
E. V. Perkins
Vice President and Western Manager
J. E. Kastrop
Director of Editorial
L. H. Johnston
Secretary-Treasurer

•

Allen K. Tyler
Production Manager
Glen D. Hebert
Assistant Production Manager
Paul J. Mansfield
Advertiser Services Manager
Charles McKean
Circulation Director
Royal Courtney
Circulation Fulfillment Manager
Sherwood R. Entwistle
Circulation Promotion Manager
Harold L. Seamans
Circulation Field Service Manager

•

NEW YORK: **John L. McDonald, Clyde Dillehay**
52 Vanderbilt Ave., MUrray Hill 6-7232
CHICAGO: **E. V. Perkins, Robert T. Mahoney**
53 West Jackson Blvd., HArrison 7-6883
LOS ANGELES: **Richard P. McKey**
465 East Union, Pasadena, RYan 1-0685
PITTSBURGH: **Art G. Gilliam**
121 Ambleside Dr., WEllington 1-0619
BIRMINGHAM: **Fred W. Smith**
1201 Forest View Lane, Vesthaven, TRemont 1-5762
HOUSTON: **Jess Adkins**
2370 Rice Blvd., Room 110, JAckson 6-2631
DALLAS: **Ed Sealey**
800 Davis Bldg., Riverside 8-4403

Cable Address: PEPUB

Member Audit Bureau of Circulation and Associated Business Publications. Copyright, 1959, The Petroleum Engineer Publishing Co., Dallas, Texas. Subscription Rates: U.S. and Canada $3.00 per year; $5.00 two years. South American and Foreign $5.00 per year; $10.00 two years. Single copies, $1.00 except August 15 Handbook issue not sold separately. Please send subscription correspondence and change of address to American Gas Journal, P. O. Box 1589, Dallas 21, Texas. Subscribers should notify publisher promptly of any change of address, giving old as well as new address, and including city postal delivery zone, if any. If possible, enclose an address label from a recent issue of the magazine. Allow one month to six weeks for change to become effective.

Printed in U.S.A.

M C F

NEWS HILITES OF THE INDUSTRY

FPC Commissioner William R. Connole, speaking like a man who would like to see the U. S. have a "Czar of Energy," indicated in an address to the National Coal Association's annual meeting in Washington in June that the time for a "meaningful, practical, and equitable energy policy" is now. Commissioner Connole said need for such a national energy policy is "so patently obvious" that he is "simply unable to understand how thoughtful people . . . can overlook it." Conceding that there might be pitfalls in creating a policy, he noted that formation of such a policy should begin with a **"study"** to be made by an **"objective"** group *dominated by the government* but using facilities of industry and independent research groups. Aim of the study, he noted, should be "legislation."

Urgently needed gas for the fast-growing California market via the proposed Transwestern Pipeline may not be realized. Project has been "nixed" by the FPC's legal staff, which continues to "mother hen" its fixation on price-fixing of natural gas in the field. The FPC staff views raised no question about the market in California *(recent A.G.A. survey calls it nation's fastest growing state in gas usage)* for the initial 300,000,000 cu ft per day destined for Pacific Lighting Company's subsidiaries. Instead, staff report cited "inadequate supply" and "field prices" as reasons for denying the applications. Gas supply of 2.353 trillion cu ft was cited as adequate for only 13 years (20 years availability usually required.) Question of field price seems real motive behind objections by FPC legal staff; it believes that only price-conditioned certificates for independent producers supplying the line could "protect" California consumers. Denial on price basis is hinged on fact that the staff feels Transwestern's field prices would not offer competition to El Paso Natural Gas (now chief supplier to California companies), would ultimately force rise in prices El Paso pays . . . and eventually have the two suppliers bidding against each other for new gas.

"So stunning as to be incomprehensible" says Transwestern in its rebuttal. In a brief filed with the Commission, Transwestern pointed out that "no time during hearings did staff challenge adequacy of Transwestern's gas supply or the availability thereof . . ." With regard to the price question, the company termed the action as playing "fast and loose with the future of the California gas consumer." To deny Transwestern and the producer applicants certificates "because of the staff's preconceived notion of producer prices would be wholly against the public convenience and necessity," the brief noted.

Endorsement of a "national energy board" for Canada has been made by the Natural Gas and Petroleum Association of Canada. In a statement issued at the association's annual meeting in Hamilton, Ontario, the group's president, John R. Reeves, stated that the association feels "there is a definite place for such a regulatory body . . . to control the inter-provincial and international flow of energy resources such as natural gas, oil, coal, and electricity." He pointed out that the Canadian oil and gas industry has been in a state of flux since the "Borden Commission" interim report several months ago and that the unsettled situation has resulted in a slowdown of industrial expansion in Canada.

Completely self-contained gas-fired, forced-air furnace that generates its own electricity to operate the warm air circulating fan, has been developed in demonstration model form by researchers at the A.G.A. Laboratories in Cleveland. The small scale prototype requires only gas for operation, uses the thermoelectric principle to produce power for the fan. Possibility of direct electric generation by heat at the point of use opens entirely new design concepts for gas appliances.

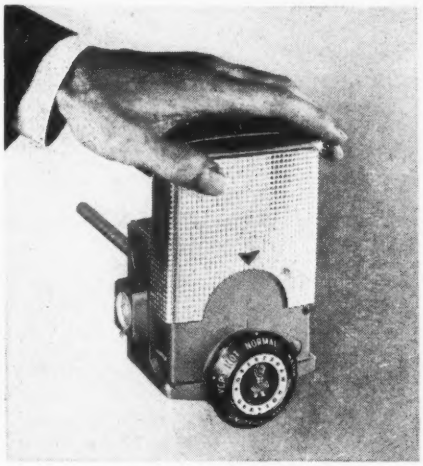
AMERICAN GAS JOURNAL, July 1959, Vol. 186, No. 7. Published monthly except August, then semi-monthly by The Petroleum Engineer Publishing Company, P. O. Box 1589, Dallas, Texas. Second class mail privileges authorized at Dallas, Texas. Executive and Editorial Offices at 800 Davis Building, P. O. Box 1589, Dallas 21, Texas.

dramatic new
exclusive control-
ON
VERY HOT NORMAL WARM
ROBERTSHAW
"Mr. Controls"
GRAYSON
UNITROL
REPLACEMENT OR REFUND OF MONEY
Guaranteed by
Good Housekeeping
IF NOT AS ADVERTISED THEREIN

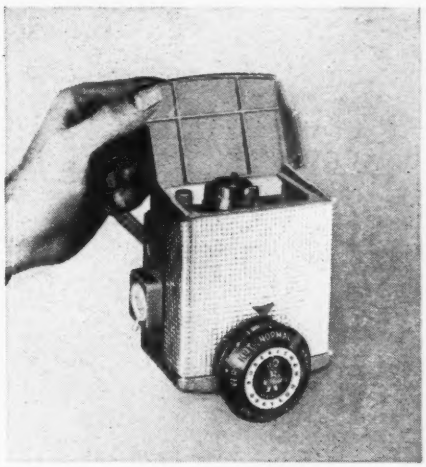
ROBERTSHAW **UNITROL 400R** provides a new, selling feature you never had before...

....DEMONSTRATION

DEMONSTRATE the most beautiful control in the world!



DEMONSTRATE the exclusive new slip-top cover!



DEMONSTRATE the exclusive new flip-top lid!

Show customers the Unitrol 400R with the slip-top cover and the flip-top lid... *for greater water heater sales*

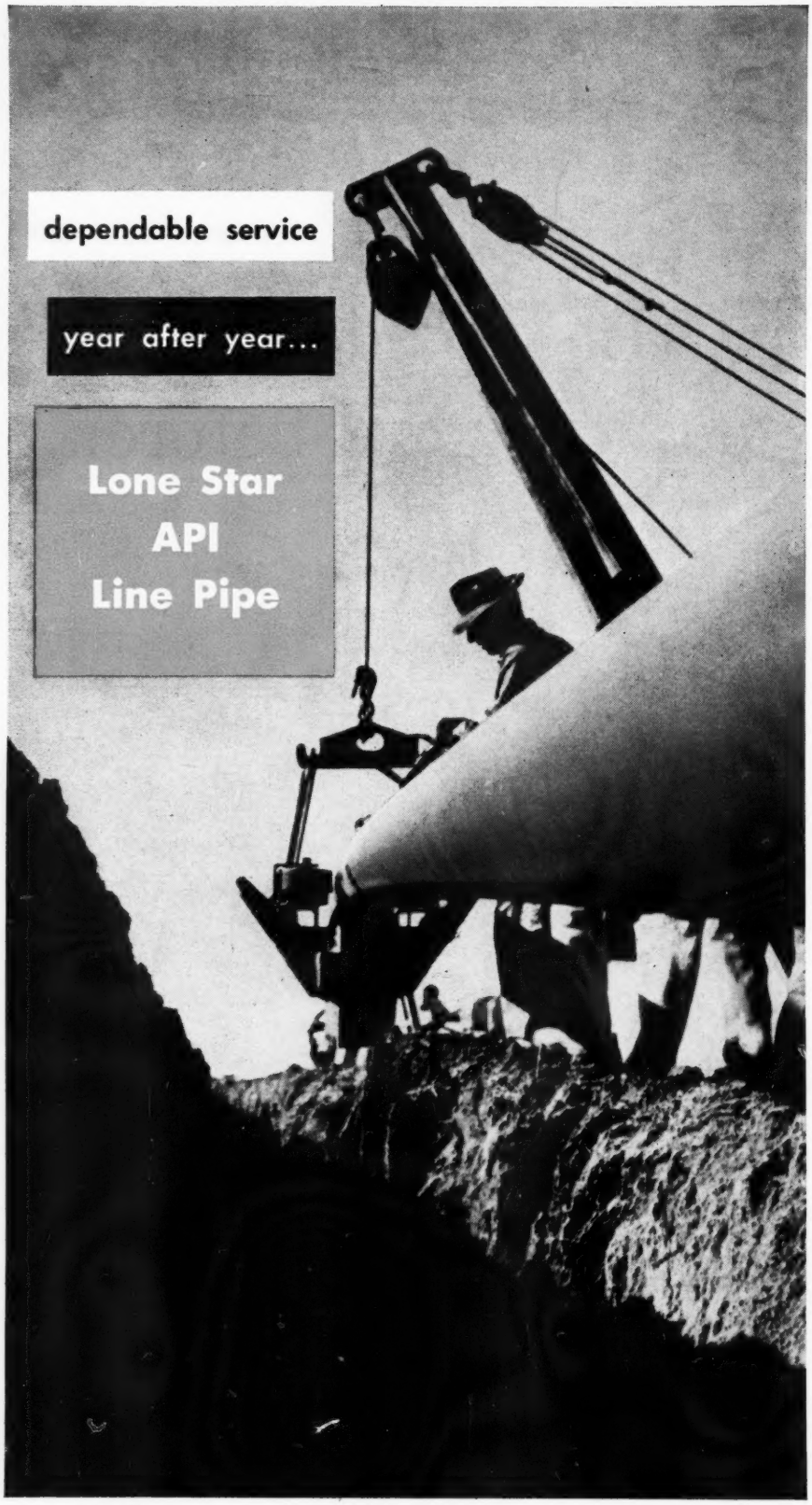
Equip your water heater with the control which will help sell it...the new Robertshaw Unitrol 400R! The lid flips up, and the whole cover slips off for easy pilot lighting. Here is a control your sales people can *demonstrate* to customers... here is a control which will enhance your water heater's ability, utility, recovery capability (the Robertshaw Unitrol 400R features a built-in pressure regulator) and reliability!

The Robertshaw Unitrol 400R will help you sell your top line water heaters or raise the sales of lower priced heaters!

FOR MORE INFORMATION CONTACT:

Robertshaw

GRAYSON CONTROLS DIVISION • LONG BEACH, CALIFORNIA



Lone Star STEEL
COMPANY

EXECUTIVE—SALES OFFICES
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas
DISTRICT SALES OFFICES
912 Republic National Bank Building, Dallas, Texas
Houston, Texas | Midland, Texas | Tulsa, Oklahoma

COMING EVENTS IN THE GAS DISTRIBUTION INDUSTRY

August

24-26 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, West Virginia.
26-28 Mid-West Gas Association, gas school and conference, Iowa State College, Ames, Iowa.

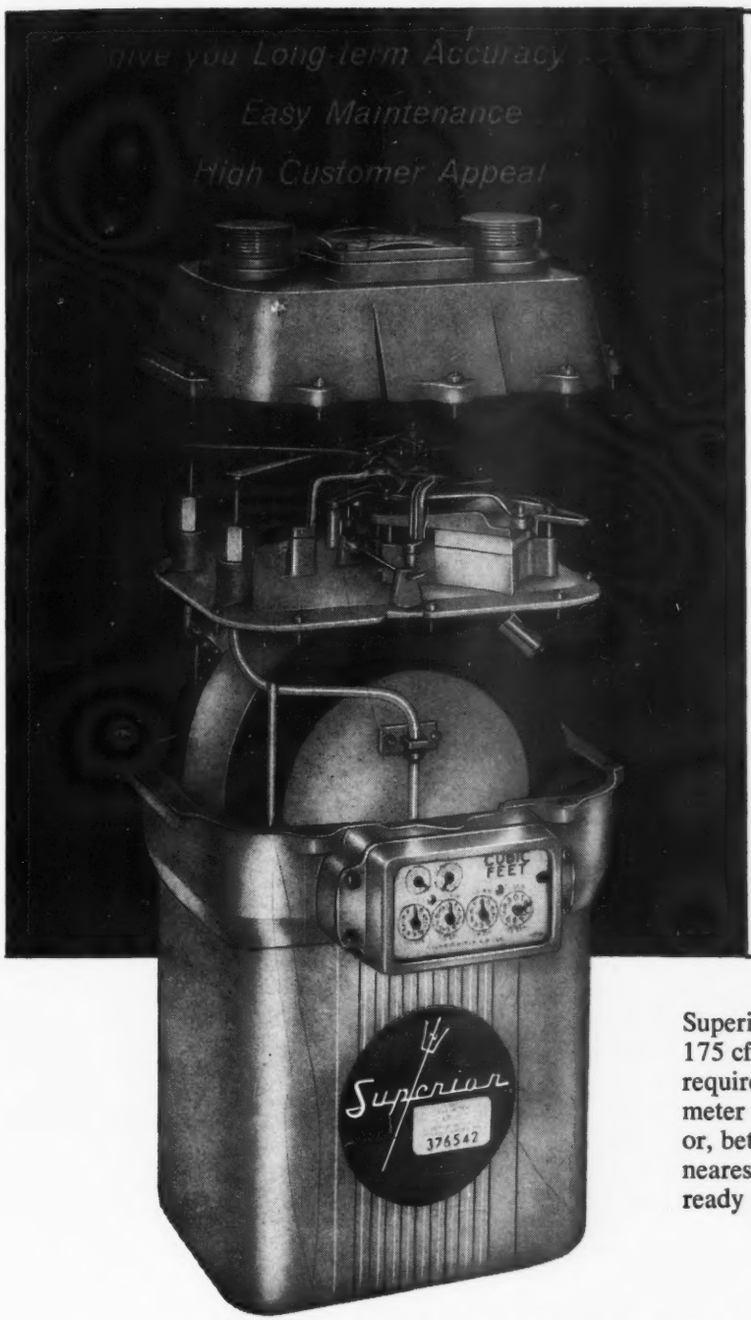
September

4 New Jersey Gas Association, annual convention, Berkeley-Carteret Hotel, Asbury Park, New Jersey.
9-11 Pacific Coast Gas Association, annual meeting, Hotel Ambassador, Los Angeles, California.
11 New Jersey Gas Association, annual convention, Essex and Sussex Hotel, Spring Lake, New Jersey.
14-15 NEGA, gas utility managers conference, Wianno Club, Osterville, Massachusetts.
14-18 A.G.A. industrial gas school, Penn-Sheraton Hotel, Pittsburgh, Pennsylvania.
15-16 A.G.A. 11th annual accident prevention conference, The Dinkler Plaza Hotel, Atlanta, Georgia.
17 NGAA rocky mountain regional, Gladstone Hotel, Casper, Wyoming.
17-18 A.G.A. Great Lakes public relations workshop, Dearborn Inn, Dearborn, Michigan.
17-19 Public Utilities Association of the Virginias, 41st annual meeting, The Greenbrier, White Sulphur Springs, West Virginia.
20-23 ASME Petroleum Mechanical Engineering Conference, Rice Hotel, Houston, Texas.
22-23 A.G.A. operating section organization meeting, Hotel Roosevelt, New York, New York.
24 NEGA safety conference, Statler Hilton, Boston, Massachusetts.
28-29 A.G.A. Textile Symposium, Greensboro, North Carolina.
28-Oct. 1 American Welding Society fall meeting, Sheraton-Cadillac Hotel, Detroit, Michigan.

October

5- 7 A.G.A. annual convention, Conrad Hilton Hotel, Chicago, Illinois.
13-14 Seventh Annual Gas Measurement Institute, National Guard Armory, Liberal, Kansas.
14-16 Wisconsin Utilities Association, operating and sales convention, Shroeder Hotel, Milwaukee, Wisconsin.
21 NEGA operating division, Statler Hilton, Hartford, Connecticut.
22 NEGA accounting division, Statler Hilton, Hartford, Connecticut.
23 NGAA, southern regional, Carlton Hotel, Tyler, Texas.
26-27 INGAA, annual meeting, Westward Ho, Phoenix, Arizona.
28-29 Computer Applications Symposium, sponsored by Armour Research Foundation, Morrison Hotel, Chicago, Illinois.
30-Nov. 1 American Society of Refrigerating Engineers, semi-annual meeting, Traymore Hotel, Atlantic City, New Jersey.

16 REASONS
SUPERIOR Aluminum Case METERS



1. **Slow movement...**
2. **Simple horizontal seam...easily sealed.**
3. **Accessible table...just remove the screws holding top.**
4. **Meter top removable without disturbing index box.**
5. **Valves readily accessible when top is removed.**
6. **Seam gasket stays resilient...**
7. **Entire mechanism lifts out with valve table.**
8. **Heavy-duty, sintered bronze bearings oil-impregnated for life.**
9. **Flag arrangement gives arm smooth operation and longer life.**
10. **Accurately-controlled diaphragm... no inaccuracies from deflection.**
11. **Cupped side flanges permit easy and safe carrying.**
12. **Calibration through convenient hand hole.**
13. **Broad base for conveyorized handling. Flats on top permit solid stacking.**
14. **Index removable without disturbing meter.**
15. **Modern appearance for quick customer acceptance.**
16. **Conforms to latest A.G.A. standardization specifications.**

Superior now manufactures aluminum case meters in 175 cfh, 250 cfh and 340 cfh sizes to meet most domestic requirements. To find out how this advanced-design meter will fit into your planning send for bulletin 1150... or, better still, phone the Superior representative nearest you. He understands your needs and stands ready to give you good, quick service.

SUPERIOR METER COMPANY, INC.

19 West 50th Street, New York 20, N. Y.

A SUBSIDIARY OF NEPTUNE METER COMPANY

neptune

Branch Offices: Atlanta • Boston • Chicago • Dallas • Denver • Los Angeles Louisville • New York • North Kansas City, Mo. • Philadelphia Portland, Ore. • San Francisco

In Canada: Neptune Meters Ltd. • Toronto • Calgary • Halifax Montreal • St. John • Vancouver • Winnipeg

15

use MUELLER® NO-BLO® Methods to

stop-off lines SAFELY under pressure!

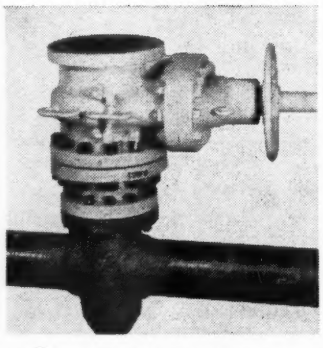
to repair leaks
to tie-in lines and loops
to replace and install equipment

All of these operations are done quickly and economically by isolating a section of line with Mueller Line Stopper Fittings and Equipment.

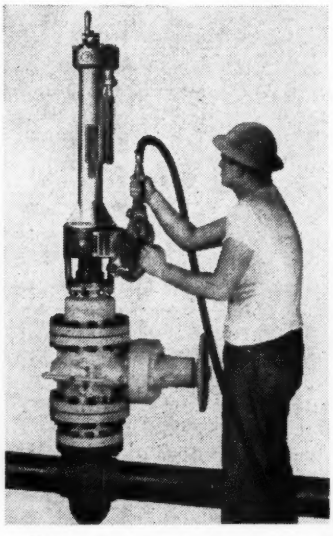
Shown below is the simple step-by-step method developed by Mueller Co. to get fast, effective stop-offs in any line. By making two pressure stop-offs at once and using a by-pass line, a section of line can be completely isolated without interrupting the flow of fluid.

A by-pass connection, built into the body of each stopping machine, makes it easy to install a temporary by-pass line with a minimum investment in time and materials. This detail of design is typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product.

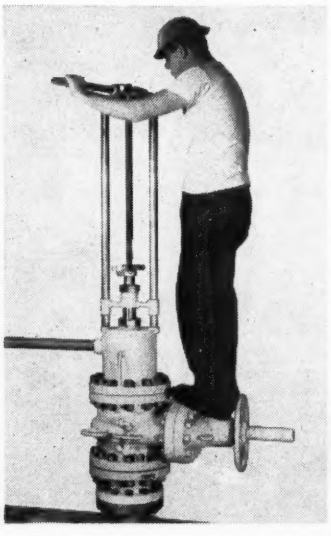
Mueller Line Stopper Fittings and Equipment may be used on lines up to 12" in size, under various pressures as high as 500 p.s.i. on most models and temperatures to 250° F. Write for complete information.



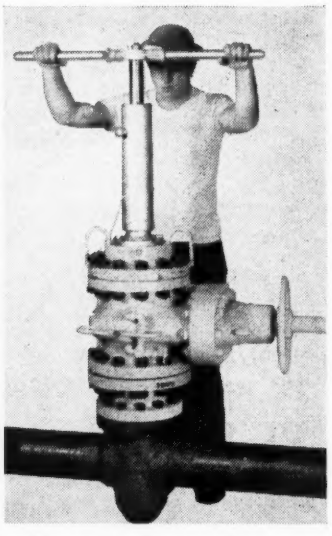
Step 1. Weld fittings to line. Bolt gate valves to fittings.



Step 2. Bolt Mueller Drilling Machine to valve. Cut-out sections of line to accommodate stopper. Remove drilling machine.



Step 3. Bolt stopping machines to valves. Connect by-pass. Stop-off line. Section of line now isolated — ready for repair, replacement or tie-in.



Step 4. Remove stopping machines and by-pass. Install completion plug in top of fitting with completion machine.

Step 5. Remove all equipment. Cap fittings.

GEM Pipes — Gas Equipment Manufacturers Group

MUELLER CO. Since 1857 Serving the Water and Gas Industries Quality

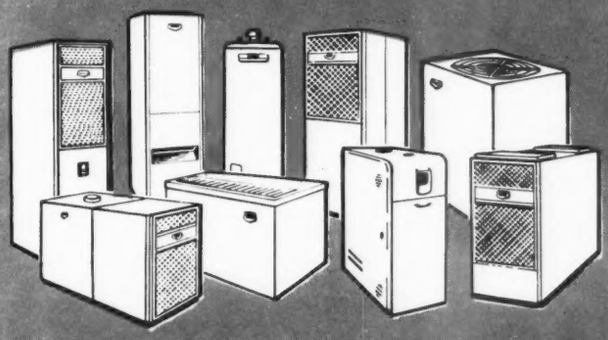
MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

NOW! Plenty of Extra

WORKING CAPITAL*

for BRYANT DEALERS!



Comprehensive Finance Plan makes it easy to

DISPLAY BRYANT
SELL BRYANT

Used successfully by many other industries, this complete plan enables the Bryant dealer to finance equipment for store displays and consumer sales in several ways:

Home Improvement Plan—Modernization and replacement sales climb when you offer *years ahead* Bryant Heating, Air Conditioning and Water Heating equipment with *no down payment*. Loan can include labor, materials—up to 5 years to pay.

Add-On Plan—Permits customer to get heating plant now, air conditioner any time after 6 payments have been made.

Skip Payment Plan—Encourages customers to install Bryant equipment during off-seasons. On heating system bought May 1—Aug. 31, first payment may be deferred to Oct. 1. On air conditioning bought Oct. 1—Mar. 31, first payment May 1.

Work-In-Process Plans—For both residential and commercial installations, keep your working capital working. Cash advanced (up to 75% of total price) as soon as contract is approved. *Also lease plans for industrial customers.*

bryant

12 SOUND REASONS WHY YOU SHOULD BECOME A BRYANT DEALER!

1 **MULTIPLE LINES:** Furnaces, Air Conditioners, Boilers, Water Heaters, Unit Heaters—widest selection of models and prices to fit any market.

2 **EXCLUSIVE FEATURES YOU CAN SELL**—backed by 51 years of engineering leadership.

3 **FAST DELIVERY**—from complete local stocks.

* 4 **COMPLETE FINANCING AND CREDIT ASSISTANCE**—suited to your needs—administered by local people who know *you*.

5 **ON-THE-SPOT COUNSEL**—sales, design, engineering, service—from your nearby distributor or factory branch.

6 **SALES AND TECHNICAL TRAINING**—by experienced specialists—both locally and at the Bryant plant.

7 **BUSINESS MANAGEMENT GUIDANCE** from factory and distributor, to help you cut costs, get more business, make more money.

8 **LOCAL AD CAMPAIGNS**—field tested—with Bryant factory and distributor participation.

9 **SOUND SELLING POLICIES**—in effect for over 50 years—protect your business and profits.

10 **BRYANT'S NATIONAL REPUTATION** with architects, engineers, builders, utilities and home owners helps *you* sell.

11 **GAS AIR CONDITIONING** gives you big opportunity to GROW—close tie-in with Gas Utility promotions.

12 **BRYANT'S FINANCIAL STRENGTH** protects your *future*.

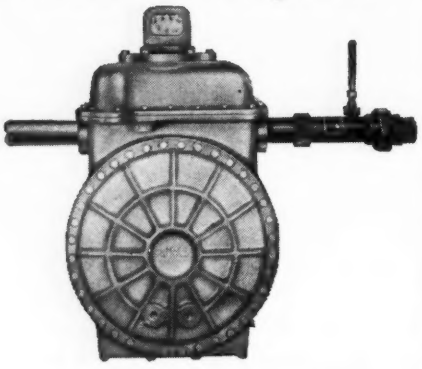
GET THE PROFIT FACTS! *Contact your Bryant distributor or write Bryant Manufacturing Company, Indianapolis, Indiana. In Canada: Bryant Manufacturing Ltd., Toronto, Ontario.*

. . . YEARS AHEAD IN YEAR 'ROUND COMFORT!

new

AMERICAN®

1000 psi working pressure critical flow prover



Designed for 1000 psi maximum working pressure, the new American® Critical Flow Prover provides economical proof testing of high pressure displacement meters in the field. The portable, precision-engineered design meets the highest standards of accuracy and dependability.

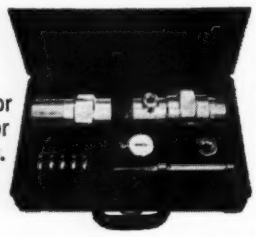
Available in 2-inch size with gas capacities from 250 to 6000 cfh. Each orifice individually calibrated.

SAVES MONEY
no costly set and removal expenses.

SAVES TIME
proof tests conducted on-the-spot.

SAVES EFFORT
no handling or transporting meters to the shop.

ASK
your American representative for Bulletin 203.1 for complete details.

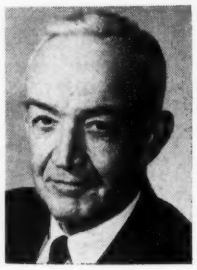


AMERICAN® METER COMPANY
INCORPORATED (ESTABLISHED 1836)

General Offices: Philadelphia 16, Pa.
Sales offices in principal cities

MEN AT WORK

IN THE GAS DISTRIBUTION INDUSTRY



J. P. Jackson

A. W. Finly

J. J. Crane

H. G. Clifford

● **James P. Jackson** and **Albert W. Finly** have been appointed assistant controllers of Michigan Consolidated Gas Company. Jackson will supervise general accounting, tax, budget and statistics, methods and procedures, and typing and calculating divisions. Finly will supervise tabulating, payroll, stores accounting, and accounts payable divisions.

● Consolidated Natural Gas Company has elected **James Comerford** chairman of the board; he will continue as chief executive officer. **E. H. Tollefson,** formerly executive vice president, has been elected president and chief operating officer of the company.

● Recent personnel changes at The Gas Service Company include: **John Hoffman,** superintendent of construction and maintenance, has been named general superintendent of the Mission division, a newly created position. **Charles Jenkins,** formerly construction supervisor, succeeds Hoffman. . . . **Harley Burns,** industrial engineer for Kansas City, has been promoted to industrial engineer at the general office replacing **J. I. Cormany** who plans to retire in the fall. **Waldo Canaday,** formerly assistant utilization supervisor succeeds Burns at Kansas City. . . . **Glen L. Blauvelt,** manager at Beloit, has been promoted to manager at Lee's Summitt succeeding **E. E. "Ernie" Laws** who retired May 1 after 28 years of service in the utility business. **Claude W. Remley,** former supervisor at Ellsworth, has been named Beloit's new manager. **Howard King,** meter shop foreman at Arkansas City has been promoted to superintendent of the Arkansas City property succeeding **Kenneth B. Mills,** who recently retired.

● **Carrington Mason** has been elected vice president in charge of operations of Houston Natural Gas Corporation succeeding the late E. S. George. He was formerly assistant vice president of operations.

● **Hugh C. Daly,** executive vice president of Michigan Consolidated Gas Company, has been elected to the board of directors of American Natural Gas Company. He is currently a director of Michigan Consolidated, Michigan Wisconsin Pipe Line Company and American Louisiana Pipe Line Company, subsidiaries of American Natural.

● **George W. Miller** has been elected treasurer of Philadelphia Electric Company succeeding **C. Winner,** retired.

● **Dan L. Mayer** has been promoted to manager of Phillips Petroleum Company's natural gas department, succeeding **R. B. Stewart,** recently promoted to vice president, natural gas.

● **John J. Crane** and **Harvey G. Clifford** have been elected assistant secretary and assistant treasurer, respectively, for Consolidated Edison Company of New York. Crane is also secretary and treasurer of Consolidated Telegraph and Electrical Subway Company, a subsidiary of ConEd. Clifford was cashier of the company prior to his recent election.

● Recent personnel changes at Cincinnati Gas & Electric Company include: **Miles J. Doan,** who has been serving as secretary and assistant treasurer, has been elected secretary and treasurer of the company; he succeeds as treasurer **William H. Zimmer, Sr.,** who continues as executive vice president. **J. Paul O'Brien,** formerly assistant treasurer, has been elected controller. **Margery G. Graham** has been re-elected assistant secretary and elected assistant treasurer. **William H. Zimmer, Jr.** has been elected assistant treasurer. **Harold J. Woehrmyer, Claude E. York,** and **George Eilers,** former assistant treasurers, have been appointed assistant controllers.

● Commonwealth Natural Gas Corporation has named **Hilton W. Goodwyn, Jr.** treasurer and assistant secretary to succeed **Charles C. Drummond** who has been named secretary and comptroller. **Grayson E. Tuck** has been promoted to assistant treasurer of the company. . . . All nine members of the board of directors have been re-elected including: **E. T. Gresham** of Norfolk, **John Mitchell** of Middleburg, **James O. Watts, Jr.,** of Lynchburg, and **John G. Hayes, Robert E. Henley, Lewis F. Powell, J. Harvie Wilkinson, Jr., E. Otto N. Williams** and **William H. Trapnell,** all of Richmond.

● **Kenneth W. Hasbrouch** has been elected assistant vice president of New York State Electric and Gas Company succeeding the late William J. Foster, Jr. He will also be manager of company's rates and regulatory department.

● Northern Natural Gas Company has elected three new vice presidents — **A. L. Vaughan,** vice president in charge of operations, southern region; **W. B. Haas,** vice president in charge of operations, northern region; and **J. O. Grantham,** vice president, employee relations. Vaughan and Haas were general managers of their respective regions prior to their election as vice presidents. Grantham was previously manager of employee relations. . . . **Dr. Gus E. Montes** has joined Northern Natural as technical director of the gas products development department. He was formerly affiliated with U. S. Industrial Chemicals Corporation as chief technologist.

Men at Work

H. C. Newton

● **Hugh C. Newton** of Rockwell Manufacturing Company's public relations department, has been named assistant director of public relations. He joined Rockwell in January 1959; prior to this, he was Rockwell's public relations representative as an account executive for Burson-Marsteller Associates.

J. W. Benson

● **John W. Benson** has been promoted to assistant national advertising manager of RCA Whirlpool major home appliances succeeding **John Trux,** who has accepted the position of sales promotion manager with the Bell & Howell Company of Chicago. Benson was formerly advertising sales promotion manager in the firm's range, laundry, and utility divisions.

● **John T. Brown** and **Marc B. Rojtman** have been elected chairman of the board, and president, respectively, of J. I. Case Company. Newly elected as vice presidents of the company are: **D. A. Beckenbaugh,** sales and manufacturing administrator; **Jack L. Bush,** controller; **Gordon A. McMillan,** director of Canadian operations; **David A. Milligan,** head of the industrial division; and **Frank J. Palermo,** in charge of Case's 8-plant diversified manufacturing operations.

J. J. Rosecky

● **Joseph J. Rosecky** has been appointed executive vice president of Clark Bros. Co., one of the Dresser Industries. Formerly vice president/operations Rosecky succeeds **F. W. Laverty** who was recently named president.

● Midwest Piping Company, Inc. has appointed three new vice presidents—**Norman B. Champ Jr.,** formerly assistant to the president and general manager of operations to vice president - administrative; **E. B. Stolle,** formerly manager of the Pacific division, to vice president - Pacific division; and **T. R. Taylor Jr.,** formerly manager of the eastern division, to vice president—eastern division.

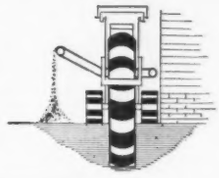
● **John E. Himmelrich** has been named eastern regional sales manager of Pittsburgh Coke & Chemical Company's protective coatings division, succeeding **Howard F. Trusler, Jr.,** who became sales manager of the division's regional office at Houston, Texas.

● Dearborn Stove Company has appointed **Charles A. "Chuck" Mathison** as their representative in Ohio and Kentucky. He has worked previously for Peoples Gas Light & Coke Company, and Minneapolis-Honeywell Regulator Company.

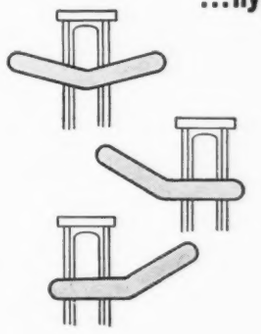
THE MACHINE / for distribution digging

...the new Cleveland J-20 trencher

- less than 5' wide over its crawlers
- digs 13" to 24" wide, down to 5' 6" deep
- puts 24" trench within 20 inches of a parallel wall
- maneuverable full crawler mounting... perfect balance and stability, easy on lawns and sidewalks
- fast, accurate, clean, dependable... nothing digs trench like a Cleveland

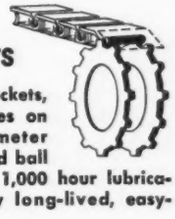


Cleveland's unique new V conveyor
...hydraulically shifted... independently driven



- digs past poles, trees, shrubs... places spoil where needed — without interrupting other operations
- lever at operator's seat controls hydraulic shifting and positioning of conveyor
- dual independent hydraulic drive gives operator fingertip control of conveyor belt direction and speed — independent of all other operations
- self-contained hydraulic motor and planetary gear drives in each head pulley eliminate all conveyor chains and sprockets
- provides constant elevating angle for faster, higher spoil discharge
- Maximum clearance under digging wheel rims permits higher heaped loads without clogging
- conveyor design reduces rolling and tumbling

world's finest trencher crawlers



...double flanged sprockets, rollers, wheels... drives on each end of 1½" diameter hardened pins... sealed ball and roller bearings... 1,000 hour lubrication... a tremendously long-lived, easy-rolling track.

hydraulic crumbing shoe

...optional, extra... pivots upward... fingertip control makes crumbing shoe advantages practical in crowded digging conditions.

engine • crawlers • hoist • wheel crumbing shoe • conveyor speed-direction-shift / *Every operation controlled at operator's seat*

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

Men at Work

● **Harry J. Trainor,** formerly assistant commissioner (inspection) of Internal Revenue has been appointed executive director of the Federal Power Commission succeeding **Henry R. Domers,** who retired effective April 30.

● Recent personnel changes at Rockwell Manufacturing Company include: **Gilbert T. Bowman,** assistant vice president Rockwell's meter and valve division, has been elected a vice president of the company. He will be in charge of the international division and petroleum and industrial division. . . . **Paul A. Wick,** assistant to the president and assistant secretary, has been elected secretary.

● Recent personnel changes at Peoples Gas Light & Coke Company include: **Wayne C. Gracey,** distribution - central district, has been promoted to senior engineer, distribution department, central district. **Chris Noplos,** former tinsmith, has been promoted to appliance repair foreman, testing department meter testing and repair section. **George D. Sandstrom,** former buyer, purchasing department, has been promoted to junior industrial sales engineer, industrial sales department.

● **Donald C. Luce** has been re-elected president of Public Service Electric and Gas Company of Newark, New Jersey. The following were elected directors for one year: **George H. Blake, William H. Blake, Theodore Boettger, Robert C. Clothier, Horace K. Corbin, Francis A. Keane, Donald B. Kipp, Donald C. Luce, Lyle McDonald, Joseph D. Scheerer, Carrol M. Shanks, W. Paul Stillman, Watson F. Tait Jr.,** and **T. Wilson Van Middlesworth.**

● Recent personnel changes at Pioneer Natural Gas Company include: **Herb Byars,** former manager at Seminole, Oklahoma, has been named manager at Tulia, succeeding **H. R. King Jr.,** who is now at Canyon. King has assumed the duties as acting manager during the convalescence of **John Hunter,** Canyon manager. King will assume full duty as manager when Hunter retires early in 1960. **R. C. McGilvary Jr.,** former assistant manager at Midland, has been named manager at Seminole replacing Byars. **H. R. Nelson,** former manager at Abernathy, replaces McGilvary as assistant manager at Midland. **Carl Barton** is Pioneer's new manager at Abernathy. He was formerly distribution sub-foreman at Littlefield and replaces Nelson.

J. H. Byrnside

C. E. Goodwin

● Hope Natural Gas Company, subsidiary of Consolidated Natural Gas Company, has elected **John H. Byrnside** secretary and general counsel and a director of the company succeeding **Denton Borger,** who retired May 1. **Claude E. Goodwin, Jr.** has been appointed to succeed Byrnside as assistant secretary and counsel.

● **George Kovac** has been appointed administrative coordinator of Norge's gas utility department replacing **William Golding.** Prior to joining Norge as a field merchandiser, Kovac was district manager for Servel, Inc.

● **Brian W. Pollard** has been appointed assistant to the general manager of Burroughs Corporation's ElectroData Division. He had previously been manager of the computer department of Ferranti, Ltd., Manchester, England.

Leo A. Mayo, controller of The Connecticut Light and Power Company since 1954, died May 22, at Hartford. He was a member and past chairman of the Management Committee of the American Gas Association accounting section.

Allen D. Maclean, 62, chief engineer of the Superior Meter Company died of a sudden heart ailment on May 24 in Punxsutawney, Pennsylvania. He joined Superior, a subsidiary of Neptune Meter Company of New York, in 1955. Before joining Superior, he was chief products engineer of Mueller Company of Decatur, Illinois.

Walter Herbert Fulweiler, consultant and former chemical engineer and consulting chemist of United Gas Improvement Company, died December 20 in Bryn Mawr Hospital, Bryn Mawr, Pennsylvania. He was president of the American Society for Testing Materials 1925-1926; received the George A. Handley certificate in 1956; awarded the Beal Medal of the American Gas Association 1908 and another in 1934; the Grasselli medal by the Society of Chemical Industry in 1922 and the Silver Medal, Sesqui Centennial International Exposition in 1926.

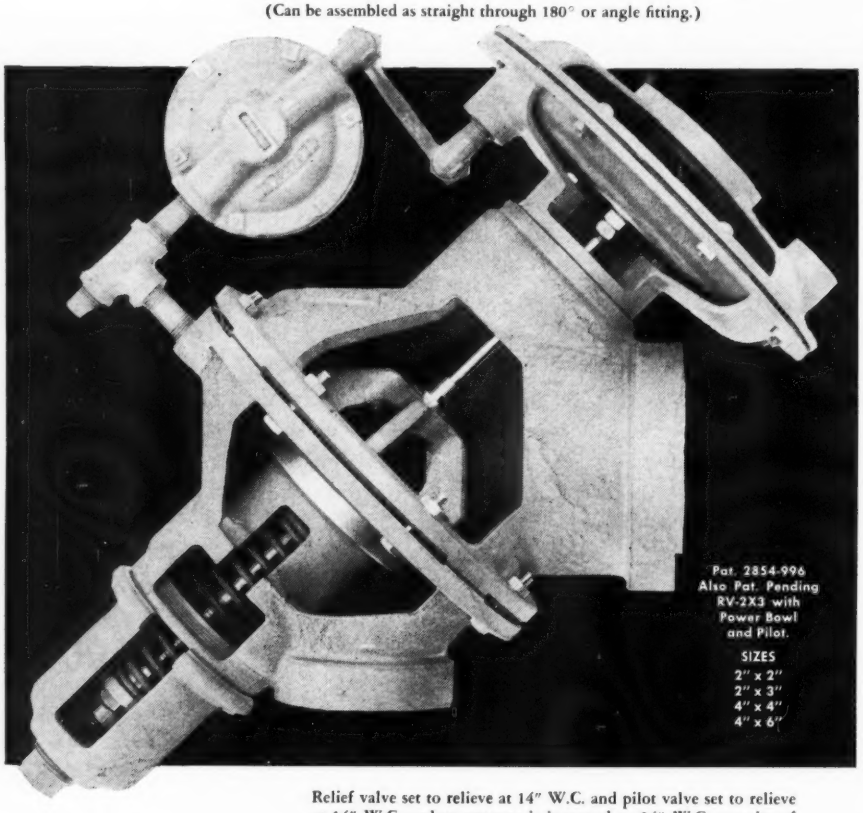
Safety
PLUS PERFORMANCE

A Pilot Operated Relief Valve that will not fail to open because of pilot failure.

With Power Bowl and/or Pilot Relief Valve improves performance with less increase in pressure for same capacity.

Power Bowl available up to 15 pounds—maximum inches W.C. to 50 pounds.

(Can be assembled as straight through 180° or angle fitting.)

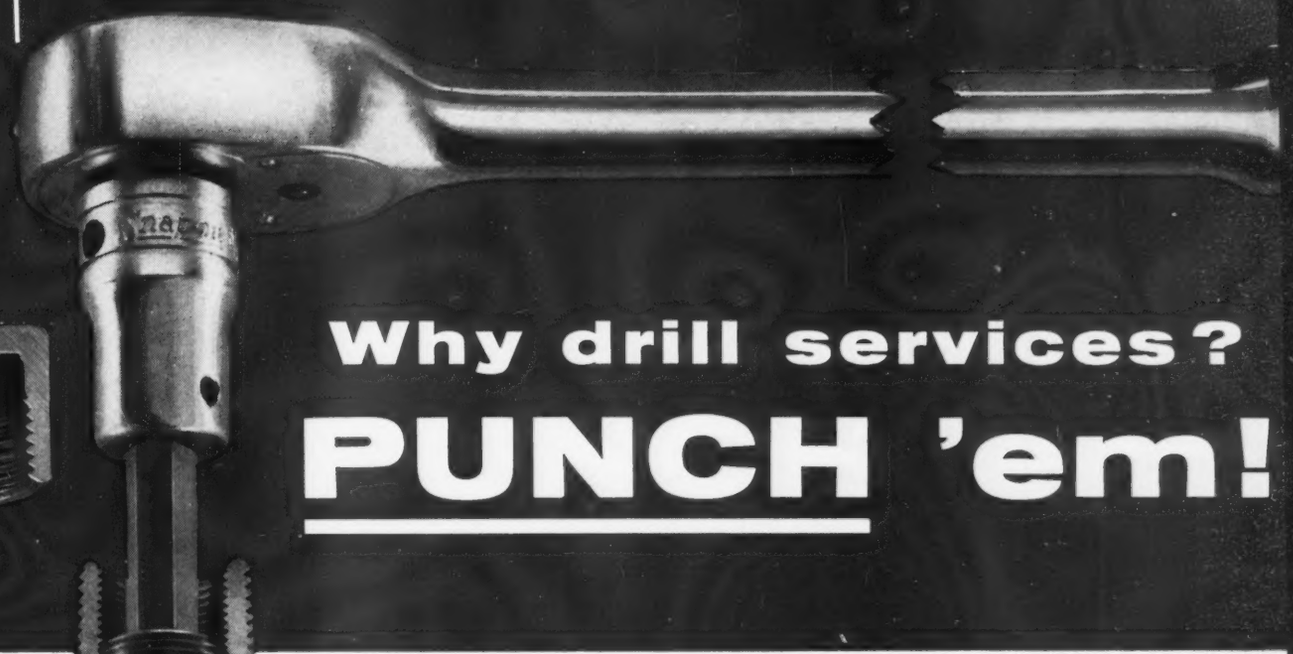


Relief valve set to relieve at 14" W.C. and pilot valve set to relieve at 14" W.C.—when pressure is increased to 24" W.C. capacity of relief valve is 24,000 cu. ft. one hour.

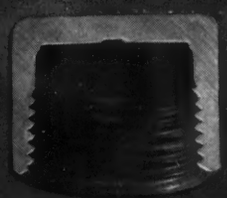
If pilot valve fails the relief valve will operate and pass the same capacity but at a pressure of 1.5 PSI—without the power bowl the same capacity will require 3 PSI outlet.

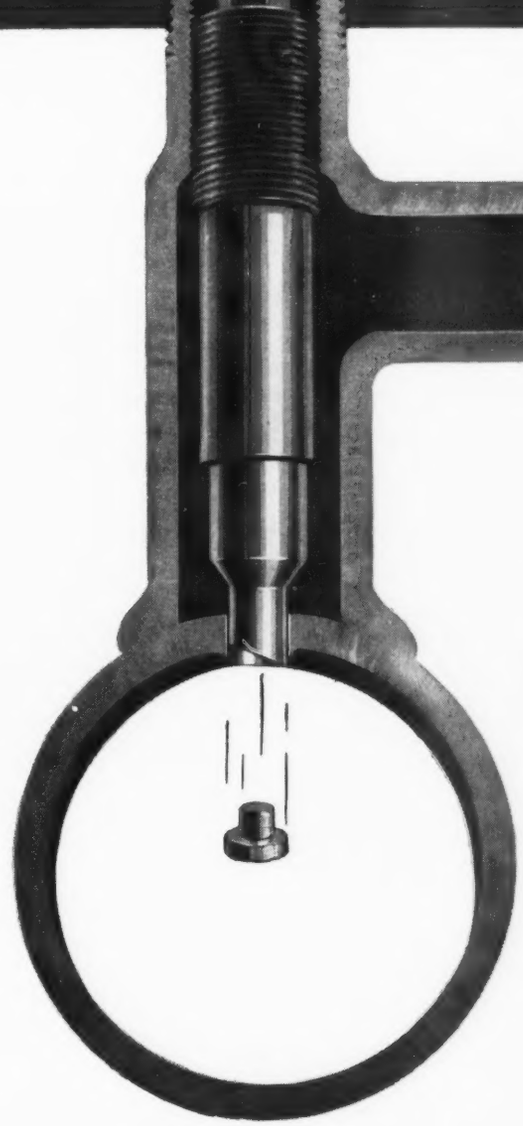
REYNOLDS GAS REGULATOR CO., INC. *Anderson, Indiana*

A Subsidiary of Arkansas Louisiana Gas Company



Why drill services?
PUNCH 'em!





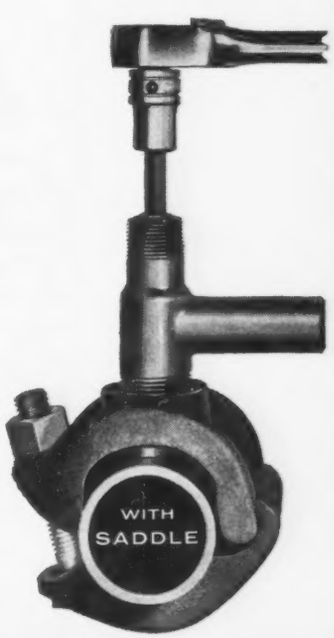
A new way for taking services off mains. A quick, safe welding tee that incorporates in each tee a punch and positive shut-off . . . doing away entirely with the use of drill devices. Punch size, 3/8" or smaller.

We also have a model for use with saddles, threaded at the base to screw into the saddle.

Each tee is tested to 5,000 p.s.i. hydraulic pressure, and carries "Rated 1,000 pounds". A 5 to 1 safety factor. A real high pressure tee. Made from steel similar to pipe, it welds easily, and in the saddle model, takes a perfect thread.

Made in two sizes, 3/4" and 1". Side outlet can be furnished 3/4" or 1", end beveled for welding, standard pipe size, either threaded, or smooth for compression coupling. Or outlet can be internally threaded for 1/2" pipe size.

With this tee you will be forever free from the cost of drilling machines, broken drills and drill machine maintenance and repairs. We feel this tee is the finest service improvement ever offered to the gas industry. Write for circular with installation instructions.



M. B. SKINNER CO.
SOUTH BEND 21, INDIANA

SKINNER-SEAL PUNCH-IT TEE

Field of golden grain and distant hills serve as colorful backdrop for work on new gas line in Arizona's irrigation farming country. Natural gas will soon be flowing through this new length of pipe distributing gas to gas-engine installations in Arizona Public Service Company's program to bring lower cost energy to the state's irrigation farmers.

Arizona Public Service introduces new concept in energy sales for gas distribution industry

NOW—'HORSEPOWER' FOR SALE

Pumps . . . plus engines . . . plus natural gas . . . combine to produce horsepower. This arrangement makes good common sense, too, from the standpoint of both supplier and consumer, believes Arizona Public Service Company.

As a result, irrigation farmers in areas served by the utility are now able to purchase cheaper horsepower for their irrigation pumping . . . without having to own the horses!

The company is currently undertaking a new type of utility service designed to substantially reduce water pumping costs for farmers in its territory.

Pumping irrigation water with gas-fueled engines, of course, is not in itself a new idea. Arizona Public Service has been supplying gas for such purposes for over a decade. Other utilities in the southwest have been doing so equally long or longer.

"Horsepower" Concept Is New

But the concept of selling "horsepower" instead of natural gas by the cubic foot is, as far as can be determined, an entirely new concept for the gas utility industry.

The cost reduction — over current methods of energy supply — is made possible through the use of natural gas fueled engines to provide the pumping power, and a device that measures only the horsepower actually delivered to the pump shaft.

By this means, the customer is billed only for the amount of "work" delivered — not for the fuel burned.

Two chief advantages to irrigation farmers under the new concept are the reduced cost of energy needed to pump water onto the land, and elimination of much of the investment that farmers are now required to make to perform such pumping.

The utility's plan is designed to reduce the farmer's financial burden of owning, servicing, and maintaining pump-driving equipment, points out Walter T. Lucking, president of Arizona Public Service.

The company will provide a gas engine, gearhead, and all accessories; it will also maintain, service, and operate the equipment for the farmers.

For those farmers who prefer to own their own gas engines, the company has revised its extension policy under which new gas supply lines are built, and will now supply farmers with natural gas as required.

Farmers Can Save Nearly 11 Percent

According to rate schedules filed with Arizona's Corporation Commission, the new "horsepower" service will afford average savings of nearly 11 percent over what the average farmer is now paying for electrical energy to operate his pumping installation.

As approved by the commission, the program is initially being offered in three areas — Harquahala Valley, Rainbow Valley, and Aguila — all agricultural areas in the company's Western and Wickenburgh divisions.

Advantages of new gas-engine program and the "horsepower" concept of energy sales are explained to farmer Phil Ladra of Rainbow Valley, center, by sales manager Brison Tucker, left, and farm specialist Joe Blazer, right.

Farmers eligible for the new service are those owning or requiring irrigation pumps in excess of 50-hp.

To date, Public Service sales personnel and farmers in the three areas have had no trouble agreeing that the new service makes good sense. Sales contact work and plans for construction of new lines and installation of equipment on the multi-million dollar gas irrigation project have been underway since April.

Intensive Study Preceded Program

Many months of intensive studies and evaluations of Arizona's agricultural economy were made before the utility decided to embark on the program. (The company now provides natural gas service to some 225 pumps serving over 40,000 acres. These pumps, however, are owned and maintained by the individual farmers.)

An important part of the study program was a series of test rate comparisons made in six agricultural areas. These tests showed that, where the farmer now spends an average 10.5 mills per kilowatt hour (including purchase and maintenance of electric pumping equipment), his cost under the natural gas "horsepower" plan would average only 8.6 mills per equivalent kilowatt hour — with the utility providing the engine and upkeep. The cost is based on 4000 hours annually, and costs would very depending on actual use of the pump.

Program Underway

The comprehensive program will be put into effect area by area throughout Arizona Public Service's gas service territory as rapidly as plans can be developed and equipment obtained. The company hopes to have the program available throughout its gas service system within two years.

Under the program, a revised line extension plan allows installation of 15 ft of piping for every horsepower of pumping load — up to a total cost of $15,000 — at no cost to the customer.

Gas engine servicemen will visit each pumping installation several times each week to log instrument readings and perform routine maintenance.

Farmers, Company Both Benefit

The program is mutually beneficial. Not only does the farmer benefit from reduced pumping costs, but the utility — in addition to increasing gas revenues and increasing gas consumption in its summer "valley" period — will be able to level off peaks in its summer electric load. For a combination gas and electric utility, the plan appears an excellent answer to the timeless problem of balancing peaks and valleys that are difficult to offset.

In the three areas selected for the initial phase of the program, work is already underway on some 580,000 ft of new lines required to distribute gas to about 65 engine installations.

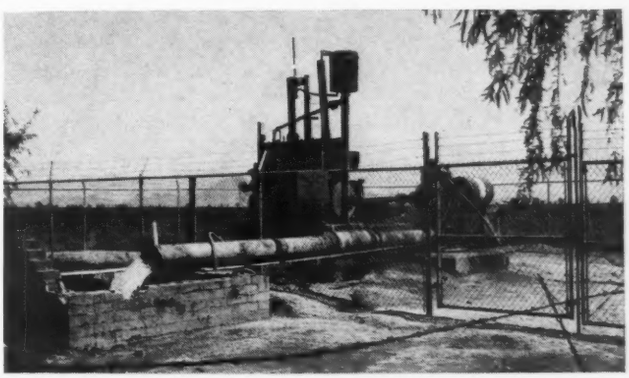
Estimated cost to Public Service for providing service to all six areas ultimately is approximately $11,000,000 for gas engines and accessories, plus another $3,000,000 for gas line construction.

Approximately 690 engines that will be required in the project would deliver a total of 804,000,000 horsepower-hours per year and could boost the company's annual gas revenues by $1,250,000.

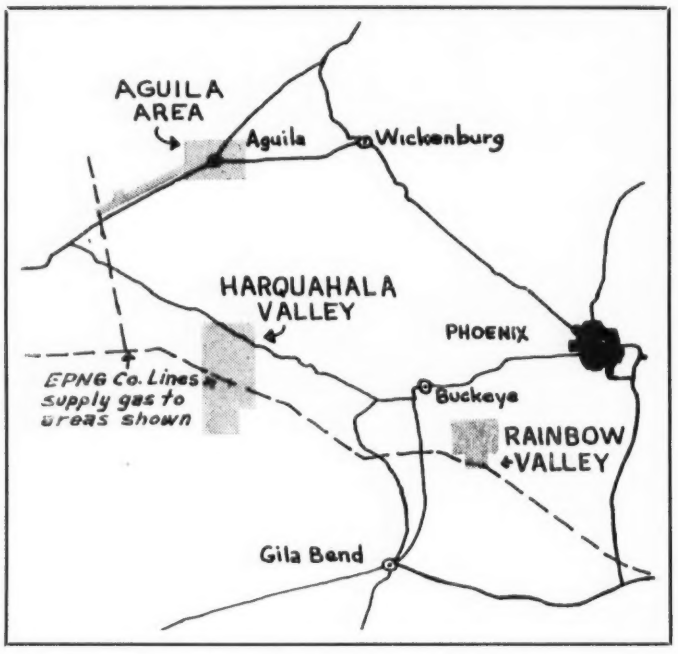
Magnitude of the program in its ultimate form might be seen in the fact that Arizona Public Service now serves 430,000 of the state's 1,240,000 irrigated acres, and provides energy to operate 1950 of the state's irrigation pumping installations.

Men on the Job

In charge of the gas engine project is Earl Jorgenson, manager of the company's gas operations. Sales planning for the project is being supervised by Bill Kimsey, gas marketing manager. Joe Blazer, rural extension consultant, heads the field sales force, with salesmen in each of the company's divisions assigned to negotiate with customers. On special assignment from the engineering department to help develop the project are Howard Hersey, Dick Johnson, and Dick Keith. Property utilization manager Bob Franklin is in charge of major maintenance and repair of the gas engine installations. * * *



Typical irrigation pumping installation powered by a natural gas-fueled engine. New program will bring many more such installations to Public Service's territory.



Map shows areas where gas-engine program is now underway and where 110 miles of new gas distribution lines are being installed.

"Big piles of long, yellow pencils" describes the stacks of plastic-coated pipe being unloaded for use in the new gas lines designed to service the irrigation pumping program.

Plastic-Coated Pipe Adds Color to Vast Gas Engine Program Construction Project

"A big pile of long, yellow pencils" is the way one workman described the stacks of bright yellow pipe being unloaded at Buckeye, Arizona for Arizona Public Service Company. In a way, he was right.

The polyethylene-covered steel pipe being gently transferred from flatcars to trucks was the result of the writing of a purchase order for the largest single shipment of pipe ever bought by the utility.

Destined for use in the company's new gas engine project for irrigation pumping, the 584,500 ft of pipe is to be used in constructing some 110.7 miles of natural gas distribution lines in the Buckeye, Rainbow Valley and Aguila areas.

The light yellow color of the pipe helps reflect distorting heat. The pipe, termed "X-Tru Coat," is made by Republic Steel Corporation. The Arizona order was the largest yet received for the new pipe product, and involved 1580 tons, mostly in 40-ft lengths, and cost almost $450,000.

The high density plastic coating, made by a low pressure process, is extruded onto the pipe at the mill. It is so tough, notes Frank Buck, gas engineering supervisor, that nothing in the soil can hurt it except a farmer's plow. The company tested the pipe for four months prior to purchasing it in quantity; the test consisted on letting a few lengths ride in a service truck, where it took — and withstood — a "real beating," even though the plastic coating is only 0.03 to 0.05-in. thick.

Savings through use of the plastic-coated steel pipe will result, says the company, from:

a. Faster field joints;

b. Longer lengths of smaller size pipe may be used efficiently;

c. Less damage to coating from handling; and

d. Reduced storage problems.

The company's purchasing department has indicated that through use of the coated pipe — as opposed to conventional pipe plus coating — savings of approximately $24,000 will be realized.

During construction, the pipe is handled and welded in the same manner as any other coated pipe. After welding, joints are cleaned and field coated by wrapping with Polyken plastic tape.

All valves in the system are insulated, provided with cathodic protection test points, and are coated with Roskote 612-XM. Current requirement tests will be made at six-month intervals. * * *

Small crawler tractors do a big job on construction of the lines. Here, crew lines up 40-ft joint of plastic-coated pipe for welder. Field joints are made with plastic tape.

Hydrostatic Testing and Purging Of Distribution Lines

S. L. Reynolds, *Staff Engineer, Distribution*
Southern California Gas Company, Los Angeles, California

WHILE THE TASK OF HYDROSTATIC TESTING OF LINES by distribution departments is essentially the same as that involving larger lines, the economics are a little more restrictive. The magnitude of most gas transmission line jobs is usually such that testing represents only a small percentage of the total cost. The employment of trained personnel or even specialized testing contractors is not unreasonable. With distribution departments, however, the smaller jobs that we are now finding it necessary or desirable to "pig" would show costs out of line unless some way of reducing the fixed charges for engineering, tooling, and supervision is found.

Furthermore, total dollars for such testing can become significant regardless of unit cost as the number of such tests increase. That we will do more and more proof testing in the future is evidenced by the trend of recent years, emphasized by the 1955 revision of the ASA Code B31.1.8. It seems reasonable to expect that, as our population density increases and as economic considerations point toward the use of higher distribution pressures, it will be necessary to qualify more of our trunk lines to operate at higher stress levels.

As time goes by, we are all learning — and rightly so — to live with more severe standards of construction, testing, and operation. I am sure there is general agreement that comfort can be derived from the feeling that our product will remain safely in its package. Our need, then, is to obtain, through testing, the same guarantee that manufacturing and construction standards are met on distribution lines as they are on transmission lines, but to so reduce testing costs that we will not be tempted to waive our own requirements in the cases of some of the "little jobs."

We feel that we have progressed in this field although our methods are by no means fool-proof. Cost reductions have been made through simplified procedures made possible by improved equipment design and handling, and by the development of written guidelines that enable line supervisors and local field engineers to perform all of the planning and actual testing in conjunction with their other work.

Planning Vitally Important

As in any other field, results can be no better than the planning. There are no real shortcuts which can safely be employed in a job of this nature. Each and every step must be observed in planning as well as in the performance. Much lost motion, however, can be avoided by careful assignment of duties and by the publication of accumulated experience so that errors are not repeated.

By placing the initial planning of the test in the hands of the same person who plans the construction of a new line, such matters as minimum radius bends, lateral connections, and reduced opening line valves will be considered for their effect on the subsequent test before unworkable ideas are carried too far. Also, in the course of route selection and surveying activities, the construction planner can be observant of possible water source and disposal points and, with relatively little additional field time, obtain elevation shots necessary to the preparation of the pressure profile. In our company, this work is done by a member of the local division engineer's staff.

The next steps consist of preparing the profile, calculating backpressure requirements, forecasting gage readings, and designating standard equipment items. Because this work is most effectively accomplished at a desk and involves talents most likely to be found in an engineering office, it too is carried out by the planning engineer.

To provide him with background necessary for understanding of his chore and to assure uniformity in the preparation of the test data, each planner is provided with a hydrostatic testing reference manual. The manual discusses the general principles of pigging and the need for the various control measures stipulated, and provides sample calculations and tables. Thus, whether he is new to his job or an old timer who has "lost touch," the know-how is at his fingertips.

The result is that when the district distribution supervisor, who is in direct charge of construction, receives his package of plans from the engineering department, it contains most of the essential information concerning the test. Here again, we feel that we have eliminated much back-tracking and path-crossing by making the man responsible for construction also responsible for the performance of the test. He is often able to combine delivery of line materials with test equipment, consider usage of pumps, compressors, etc., in dual roles, and plan spoil placement, materials storage, and such so as to provide least interference with testing. In addition, the advance knowledge of the test necessary for the planning phase allows the field supervisor time to become completely familiar with the testing routine he will follow when the day arrives.

Manual Provides Data

Because we have approximately 32 distribution supervisors, any of whom might be called upon to conduct a

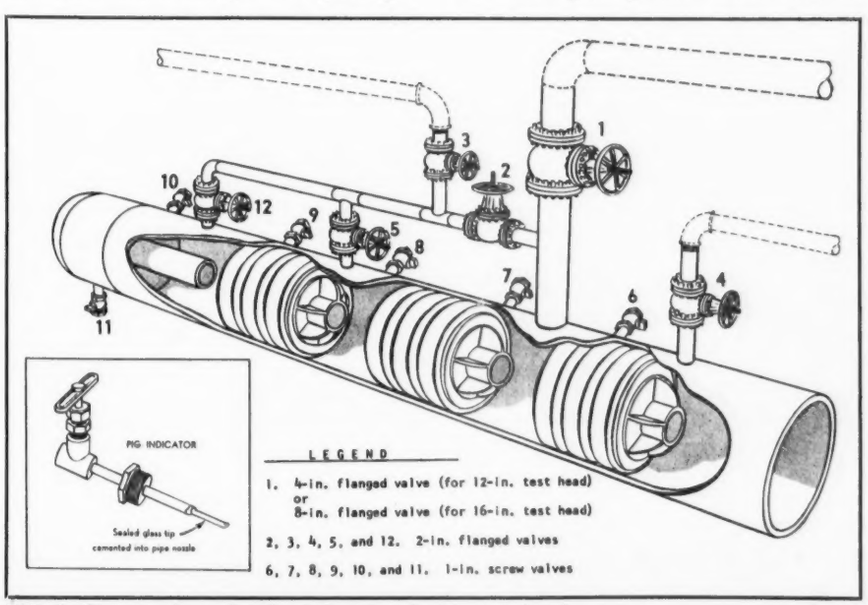


FIG. 1. Diagram shows details of the 12 and 16-in. test heads.

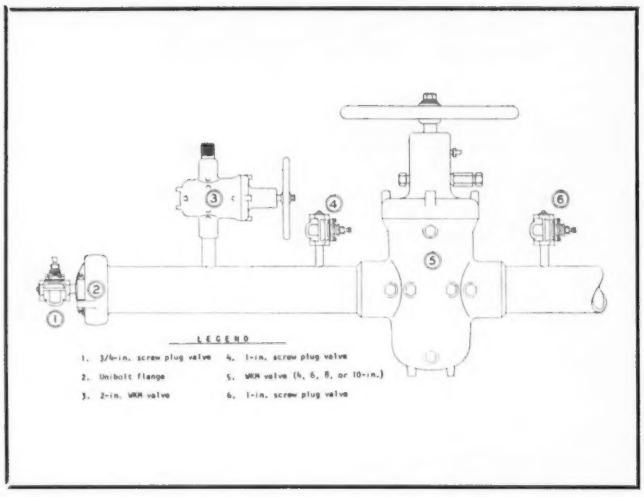

LEGEND
1. 3/4-in. screw plug valve
2. Unibolt flange
3. 2-in. WKM valve
4. 1-in. screw plug valve
5. WKM valve (4, 6, 8, or 10-in.)
6. 1-in. screw plug valve

FIG. 2. Diagram shows fabrication details of 4, 6, 8, and 10-in test heads.

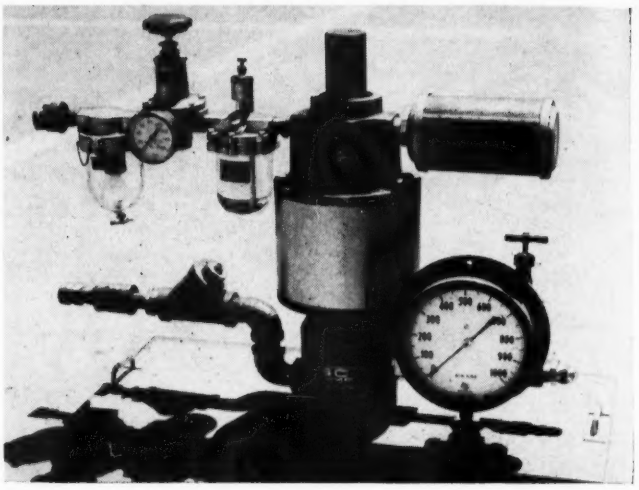


FIG. 3. Small, light-weight, air-driven pump is used to raise line to test pressure after it is filled with water.

hydrostatic test in his district, each must have some sort of guidelines to assure uniformity of methods and results. We have attempted to accomplish this through issuance of a distribution department hydrostatic testing manual. This manual is intended to take up the testing problem at the point where the engineering department leaves off and carry the discussion through to the completion of the test.

By use of this manual, the field man is provided background sufficient for his understanding of the general principles of hydrostatic testing as well as specific instruction covering planning and the mechanical operation of the test equipment.

Perhaps the most important items of planning that are the responsibility of the field man are the selection of optimum pig speeds and the proper sizing of filling and discharge lines so that these speeds may be attained. Our experience has indicated that "lost" pigs and excessively long fill and drain times have often been attributable to underestimating pressure drop through the supply and discharge lines. The result is decreased water flow which, of course, means reduced pig speed and the increased likelihood of fluid bypassing when the pig reaches an ell or other restriction.

The manual provides tables and simple formulas by which minimum pig speed can be forecast in accordance with size and length of the line, size and length of auxiliary lines, supply pressure available, and maximum expected backpressure and hydrostatic head pressure.

Charts, formulas, and examples afford knowledge of the time and equipment needed to provide necessary backpressure, the need for booster pumps, and whether or not draining can be accomplished economically using standard 100 psi air compressors. It is not intended that all combinations of circumstances be discussed, but it is expected that the general rules and guidelines will cover the vast majority of situations likely to be encountered and that the field supervisor will know when he faces an unusual situation so that he can ask for staff assistance if needed. If the tables and formulas provided are not accurate within the limits of the predictability of the reference data, they are at least weighted on the safe side.

The actual sending, tracking, and receiving of the pigs is little affected by local conditions after the planning and setup have been accomplished. Therefore, we were able to include in the manual a detailed, step-by-step procedure for the actual operation.

Equipment Development

Early tests conducted by our distribution department were on 12 and 16-in. lines. We were fortunate in that our company's transmission department and the major pipelines engineering section had already amassed a wealth of experience in the testing of lines of these and larger sizes. We not only were able to obtain from them able assistance, but we also used equipment, including test heads, developed by these groups.

The type of test heads used on larger diameter lines, Fig. 1, are satisfactory when their operation is in the hands of experienced personnel. Care is necessary, however, in the positioning of the pigs in the head, in the observance of the length of the bumper block, and in the manipulation of the equalizing valves to prevent premature release of the pigs. We soon realized that if we were to simplify testing procedures to the point that our field supervisors could conduct such tests without the assurance of long experience or knowledge of all the fine points, our first need was for a simplified type head.

Thus, we evolved the head shown in Fig. 2, which makes use of a full opening block valve and a Unibolt type end closure. This head, although more expensive initially, allows insertion and removal of pigs after the head is welded to the line whether or not the line contains backpressure or hydrostatic head pressure; allows space behind the pigs to be purged of air or water without danger of premature pig release; and eliminates cutting and welding of end caps and bumper blocks. If it is desired to return the test water to the source end for disposal, it is possible to do so without the use of reversible pigs even if filling is at the highest point on the line.

For the more commonly used sizes, 4 to 10-in., the additional cost of this type head is more than offset by the added convenience and safety in the field. For the 12-in. and larger sizes, however, the advantages of the block valve and Unibolt end are not sufficient to justify the high initial cost and weight. Therefore, in these sizes we made no change.

Pig Arrival Indicator

As a positive indication of the arrival of a pig in the receiving head, we use a simple, expendable glass tube device that is fabricated in our own shops. This is illustrated by the inset in Fig. 1.

It consists of a short piece of glass laboratory tubing with one end sealed and the other cemented to a ¼-in. pipe nipple. The nipple is long enough that — when it is screwed into a standard 1-in. by ¼-in. bushing, and the bushing is inserted in a 1-in. valve on the test head — only the sealed glass tip will protrude into the head. Another ¼-in. nipple and a ¼-in. valve are then attached to the top of the bushing. The device is "cocked" simply by opening the ¼-in. valve. As long as the sealed glass tip remains intact, no fluid will escape. When the pig passes into the head, however, the glass will be

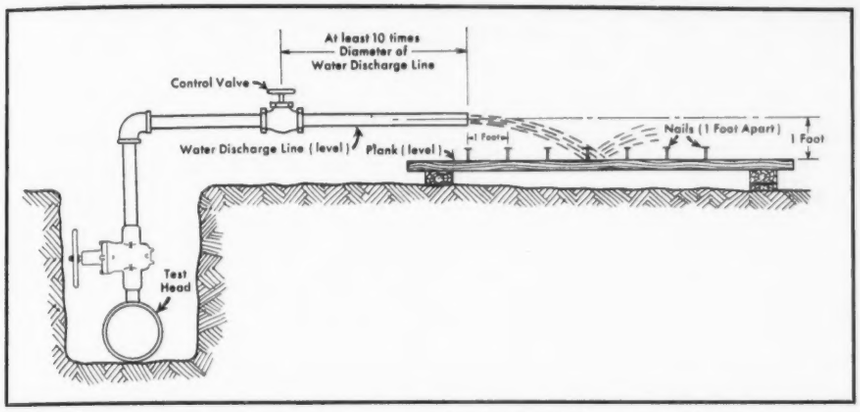


FIG. 4. Line draining set-up is used to measure rate of water discharged, which in turn measures speed of pig traveling through line.

broken and a shower of water, air, or gas tells the story.

Some of its simplicity is lost, however, when it is necessary to install a new pig detector under a head of water. In this case, a more elaborate setup is required. We are currently looking at the possibility of installing a bi-directional flag-type signal on each test head.

Air Driven Pump Used

To raise the line to test pressure after it is filled with water, we use the small, light-weight, air-driven pump, shown in Fig. 3. Light enough that it can easily be transported by passenger car and can be lowered into an excavation where short, high-pressure connections may be used, it is capable of raising the pressure in a mile of 6-in. from zero to 1000 psi in approximately one-half hour. Operating on the discharge from a standard 100 psi air compressor, it is rated at 2 gal per min of water at 1000 psi. Cost in 1955 was less than $400.

All equipment used in hydrostatic testing is in the care of our special services department and is stored at a central warehousing point when not on a job site. Special forms designating the major items required for each job and the date and location for delivery are forwarded to this central tool depot. In many instances, except when the larger size heads are called for, hauling can be accomplished along with the regularly scheduled delivery of other items to the proper district.

"Packaged" Accessories Save Time

A standard "package" of small fittings, pig detectors, gage manifolds, hoses, adapters, etc., is included with each order without separate listing. This has saved much last-minute delay on the job searching for easily overlooked items that could prove to be the horseshoe nail that "loses the battle."

Not only does central storage of equipment provide easy accumulation and delivery of needed items, but it also enables a single group to become familiar with inspection and repair so that faulty equipment is not sent to the job. Pig rubbers, for example, are checked for wear when they are returned to the depot.

For this purpose, rings made from the appropriate ID pipe are passed over the assembled pig. If any rubber passes through without force, it is replaced.

Draining the Line

When water disposal or high hydrostatic head considerations require draining the line from the same end from which it is filled, the problem of running the clean-out pig in the opposite direction is presented. With the small size heads having the full opening block valves, this is merely a matter of closing the valve, removing the pig through the Unibolt end, and turning it around.

"Reversible" Pig

On the larger size heads not equipped with such valves, however, any attempt to remove the filling pig from the receiving head — unless it happens to be at the highest point on the line — would result in a flood. For this situation we have successfully used a "reversible" pig, which can travel in either direction without turning around.

Developed and manufactured by the T. D. Williamson Company, it is similar to their regular four-cup displacement pig but has two cups facing one direction and two in the other.

To assure adequate water removal, one conventional pig is installed in the receiving head prior to filling the line. It remains in place during the filling and test phases. The reversible pig is used alone to fill, but for clean-out it is followed by the already-in-place conventional pig.

Tracking the Pigs

Various methods have been used for keeping track of the pigs' speed and location during the draining operations. All have involved relating pressure readings at each end of the line to the pressure profile. The pressure required at the sending head to maintain a constant receiving head pressure was an indication of the pigs' position.

Speed could not be predetermined and even after it had once been established would change to an unknown if it became necessary to retard the flow of water. It has always been felt that measurement of the rate of water discharged would afford more positive control of the draining phase, but an ordinary water meter on the discharge line would suffer damage from the passage of construction dirt missed by the fill pig, the intermittent discharge of water and air, or the high velocity usually desired.

We have found that sufficiently accurate water measurement is afforded by simply measuring the trajectory of the stream of water emitting from the end of the drain line. The only field equipment needed is a plank with nails one foot apart placed to act as a splash board one foot below the end of the level discharge pipe. This setup is shown in Fig. 4.

By reference to a table provided in the manual, the length of water jet required to produce the desired pig speed is known before draining is commenced. (Since this rate of flow will have been considered in the sizing of the auxiliary lines, there is no doubt that it is attainable.) All that is then required to start and maintain the pig at the pre-selected speed is to apply pressure at the sending head, open the drain valve until the water stream strikes the proper nail and control the stream at that point throughout the run by adjustment of the bleed valve. Since speed is constant, the pigs' distance from the sending head is a function of time.

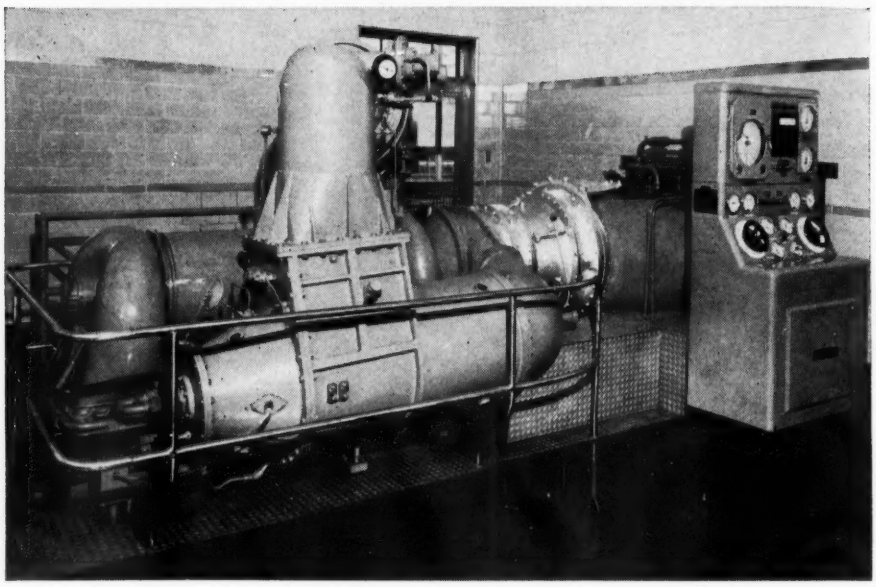
Another advantage of this method is that as the pig nears the end of the run, inlet pressure can be reduced, the drain valve opened more to compensate, and the run ended with a minimum of residual pressure in the line.

The preceding material lists measures that we feel have afforded our company a cost reduction in this very necessary phase of our distribution operations. To sum up our thoughts on this subject, we are now performing more hydrostatic tests than ever before, and we believe the rate will increase. Therefore, as in any operation having an appreciable multiplier, we must strive always for more efficient performance.

Acknowledgment

This article adapted from a presentation made at the 1959 Pacific Coast Gas Association Distribution Conference, Santa Barbara, California. ★ ★

"Total" Energy Conversion Concept Makes Gas Turbine Cycle Most Efficient Available to Industry



Model TA Gas Turbine is rated at 1265 bhp at sea level and ambient temperature of 80 F, has great potential in field of air conditioning for wide variety of industrial and commercial applications.

For large-scale commercial and industrial applications . . .

GAS TURBINES FOR AIR CONDITIONING

C. R. Apitz, *Gas Turbine Applications Engineer, Clark Brothers Company, Houston, Texas*

FOR MANY YEARS, THE GAS TURBINE has been the "glamour girl" of the power industry. Early installations have now been in operation long enough to confirm claims of low operational costs made by early proponents of gas turbines. Design improvements, equipment unitization, and the development of efficient installation techniques have brought about a continuing reduction in installation costs. New application techniques are being developed and installations are being made in new segments of industry at an increasing rate every year. Today, the gas turbine is rapidly changing its role from "experimental glamour girl" to a "money-making workhorse."

The gas turbine has long had attributes that make it attractive as a prime mover. Two recent developments in the gas turbine industry have made its use even more widespread in general industry. One, the range of sizes has been widened with the introduction of the Clark Brothers Model TA turbine, which is rated 1265 bhp at sea level and 80 F ambient. This makes available a commercial turbine of a size useful for many industrial applications and having the conservative design required for long life and extended continuous runs at full rated load.

Another important development is best described as the concept of "*total*" application. All power cycles are for the conversion of fuel energy to more usable forms. Some cycles produce shaft power only. The gas turbine actually produces both shaft power and economically recoverable heat energy. When this "total" energy conversion is considered, the gas turbine cycle is the most efficient cycle commercially available to industry.

In industrial applications involving the "total" energy conversion, the increased efficiency of the gas turbine and waste heat recovery equipment adds fuel savings to the other advantages of lower maintenance, lube oil, and operating labor normally attributed to the gas turbine.

Mechanically, the turbine has a wide field of application for driving generators, pumps, and compressors. Thermally, the turbine waste heat recovery systems are also of sufficient flexibility to permit profitable application in many industries. The exhaust heat can be used for heating water or other process liquids or gases, making steam, drying, or a combination of several of these uses. The gas can be refired in boilers, dryers, rotary kilns and other similar equipment. "Profitability" is a direct function of the balance between the power and heat requirements of each particular plant.

Air Conditioning Uses

One of the newest "total" applications — and one that appears to have a great potential — is in the field of air conditioning. The turbine has considerable flexibility in adapting to the requirements of a wide variety of industrial and commercial jobs in this field. In general, the gas turbine driven air conditioning plant is competitive with a steam turbine driven plant but more expensive than motor drive from the standpoint of initial installed cost of the complete air conditioning and heating plant.

An analysis of the cost to own and operate the gas turbine powered air conditioning plant, compared with the other cycles and on the basis of several independent studies, establishes that savings resulting from use of the gas turbine will pay-out in less than five years the incremental investment over any other cycle.

Use Exhaust Heat

The gas turbine will fit a wide range of air conditioning tonnage requirements. The turbine shaft power can be used to drive a 1200-ton packaged mechanical Freon refrigeration unit, a 900-kw generator for power generation, or other pumps and compressors as required. The exhaust heat from a Model TA turbine can be used to produce enough 15 psig steam to drive a 530-ton Lithium Bromide absorption refrigeration package, or enough 125 psig steam to drive a 675-ton steam turbine driven mechanical Freon refrigeration unit when either system is producing 42 F chilled water.

One of the most important attributes of the steam produced by turbine waste heat recovery is the sustained efficiency of part load operation and the fact that it can be used to produce refrigeration in summer, comfort heating in winter, or steam for process all year.

Study Reveals Advantages

An analysis of an 1800-ton air conditioning plant recently completed by the York Corporation provides a clear picture of the advantages of gas-turbine driven air conditioning. The study is intended to be used as a guide to further investigation of owning and operating costs of various methods of developing the required refrigeration and is indicative of a trend in larger tonnage air conditioning where air conditioning and comfort or process heat is required simultaneously. The following systems were included in the study:

A. **All electric motor drive.**

B. **Gas turbine-centrifugal compressor and an absorption system operating on waste heat generated steam.**

C. **Gas turbine-centrifugal compressor and a steam turbine operating (condensing) on waste heat generated steam.**

D. **Condensing steam turbine driven centrifugal compressor.**

E. **Steam turbine-centrifugal compressor (non condensing) and an absorption system operating on 15 psig back pressure steam.**

The study of the above systems is compared for air conditioning; however, this same type of analysis can be applied to a wide variety of projects in the refrigeration field. Details on each system are given in this article.

The York study is excellent and certainly points to the "profitability" of using gas turbines even though it does not include two advantages over the electric motor driven plant that will increase the operating savings and reduce the payout time of the incremental investment even below the attractive figures it shows.

This study is based solely upon operation as an air conditioning unit, and does not include the operation encountered in many plants where cooling and heating are required simultaneously at many times of the year. This situation occurs in many large buildings where the core of the building requires the circulation of cool conditioned air for the comfort of the occupants and yet the perimeter of the building, which is exposed to low winter outside air temperatures, must be heated.

An example of this is an industrial plant where a high percentage of the air conditioning load is for removal of heat radiated by machinery. This load is constant and results in a situation where the air conditioning is required for heat dissipation and humidity control even at low outside air temperatures that will require heating of the offices and other parts of the plant. One such plant analyzed required 25 percent of its design capacity at a 20 F outside temperature. This same plant also has a continuous process steam load that can be supplied most of the year by recovery of the gas turbine exhaust heat. Hospitals and hotels are other examples of this combined requirement for cooling and heating.

While the study is based upon 4000 hours operation per year at varying capacities, in many parts of the Southwest and particularly in installations such as those outlined above, operation will be a considerably greater number of hours per year. Operating savings will increase as a direct function of all operating hours at full and partial loads.

Analysis Must Be Sound

One of the most popular misconceptions about proper operating cost analysis is that of equating air conditioning operating costs at all percentages of the design rating to "equivalent full-load hours."

This gives a particularly warped and inaccurate comparison of electric motor and gas turbine driven plants. First, the gas turbine plant with waste heat recovery has a very good part load efficiency. Second, the "*equivalent full-load hours*" analysis **does not show the effect of electric power demand charges on those months of the year when the air conditioning system is in operation for very brief periods of time.**

At times like this, the electric power billing procedure is such that if the system reaches full load for only a short time the full demand charge will be paid.

With a gas turbine driven system the gas bill is paid in accordance with total usage and no charge is made for a brief maximum demand.

This situation is prevalent in the Southwest where there are some brief periods of every month in the year when some air conditioning is required. At part loads the auxiliaries of the steam turbine and absorption systems will require more electric energy than the auxiliaries of the all electric system, but it can be seen from the evaluation that this is canceled out by the overall efficiency of the combined cycle.

Combination Power and A/C Systems

Many large industrial and commercial plants develop loads such as the one outlined in the York study. However, there are many more installations that will not require the full 1800 tons capacity but will require a smaller air conditioning plant as well as electrical power generation or mechanical power for pump or compressor drive. Examples of this might be breweries, meat packing plants, food processing plants, office buildings, shopping centers, hospitals, hotels, airport administration buildings, amusement parks, and many others.

Comments and data presented in this article are intended to stimulate further thinking on the subject and should not be considered as an end in themselves. The future of the gas turbine in the field of air conditioning and other fields is a function of the creative thinking of the engineers who design industrial and commercial utility systems. It is hoped that this article will be helpful in generating that creative thinking.

Acknowledgment

The author would like to acknowledge the excellent help provided by George C. Briley, York Corporation, Houston, Texas, and Frank Wright, Southern Union Gas Company, Dallas, Texas. Their collaboration in the preparation of this article was greatly needed and appreciated.

NEXT MONTH, the author presents data on the basic turbine cycle and methods for calculating ways and means of utilizing exhaust heat for "total" applications.

TABLE 1

Investment Cost Comparison

System	A	B	C	D	D_1*	E
First Cost (Installed)	$528,000	$601,000	$618,000	$587,000	$647,000	$608,000
Fixed Costs						
Depreciation 5%	$ 26,400	$ 30,100	$ 30,900	$ 28,000	$ 32,400	$ 30,400
Taxes & Insurance 2%	$ 10,550	$ 12,040	$ 12,350	$ 11,550	$ 12,950	$ 12,150
Interest on investment 4%	$ 21,100	$ 24,100	$ 24,700	$ 23,500	$ 25,900	$ 24,300
Total Fixed Cost	$ 58,050	$ 66,240	$ 67,950	$ 63,050	$ 71,250	$ 66,850
Operating Cost (Air Conditioning only).	$ 87,069	$ 43,848	$ 44,601	$ 67,824	$ 55,893	$ 55,843
Total Fixed & Operating Cost**	$145,119	$110,088	$112,551	$130,874	$127,143	$122,693
Savings per Year	Base	$ 33,031	$ 32,568	$ 14,245	$ 17,976	$ 22,426
Payout Years	Base	2.20	2.76	4.15	6.63	3.56

*System with multi-stage 13 lb per hr per ton Steam Turbines.
**Maintenance on all systems assumed as equal.

TABLE 2

Installed Cost Comparison

Item No.	Item	SYSTEM A All Elec. 1—800-hp 1—1000-hp	SYSTEM B Mark TA Gas Turb. W/Abs. 1250-ton Cent. 600-ton Abs.	SYSTEM C Mark TA Gas Turb. W/Steam Turb. Drive Cent.	SYSTEM D All Steam Turb. Drive System 2—900-ton Systems	SYSTEM E Steam Turb. Drive W/Abs. 600-ton Turb. 1200-ton Abs.
1.	**Refrigeration Equipment:** Steam turbine and steam condenser; motors and starters; gas turbine and/or absorption systems (Installed)	$210,000	$280,000	$290,000	$206,000	$210,000
2.	**Boiler or Waste Heat Generator:** Complete with burner and controls, instrumentation (waste heat generator to have auxiliary firing system) (Installed)	30,000	48,000	48,000	68,000	68,000
3.	**Deaerator W/Pumps** (Installed)	8,000	8,000	8,000	9,000	9,000
4.	**Cooling Tower** (Installed)	28,000	35,000	35,000	43,000	43,000
5.	**Chilled Water Pumps** (Installed)	3,520	3,520	3,520	3,520	3,520
6.	**Condenser Water Pumps** (Installed)	4,700	5,800	5,800	5,800	6,800
7.	**Rigging of Items 1 and 2**	6,000	6,500	6,400	6,400	6,500
8.	**Foundations** (Installed)	3,800	5,200	4,500	4,500	5,200
9.	**Insulation** (all types Installed)	12,000	10,000	11,000	13,000	12,000
10.	**Boiler Breeching** (Installed)	1,500	1,000	1,000	3,000	3,000
11.	**Pressure Reducing Valves** (Installed)	.....	.....	1,800	1,800	1,800
12.	**Condenser Water Piping** (Installed) (To tower within 40 ft of equipment room)	12,000	12,000	13,000	14,000	14,000
13.	**Chilled Water Piping** (Installed) (Within equipment room)	14,000	14,000	14,000	14,000	15,500
14.	**Steam and Condensate Piping** (Installed)	12,800	20,400	22,500	39,000	44,000
15.	**Miscellaneous Pipe and Fittings** (Installed)	5,000	6,500	7,000	8,000	9,000
16.	**Finish Painting and Color Coding**	6,500	6,500	7,000	7,000	6,800
17.	**Electrical Wiring:** For refrigerating machines including breakers (Installed)	45,000	.....	.....	.....	.....
18.	**Electrical Wiring:** For other motors including breakers (Installed)	17,000	21,000	20,000	20,500	22,500
19.	**Air Cooler:** For gas turbine inlet air	.....	4,000	4,000	.....	.....
20.	**Total Costs, Complete Refrigeration and Boiler Plant**	419,820	487,420	499,520	466,520	480,620
21.	**Contingency**	15,000	15,000	15,000	15,000	15,000
22.	**Profit and Overhead:** 15%	62,973	73,113	74,928	69,978	72,093
23.	**Total Price, Complete Installation**	497,793	575,533	589,448	551,498	567,713
24.	**Building Cost** @ $10 per sq ft with boiler and water chillers on same level	30,000	25,000	28,000	35,000	40,000
25.	**Total Cost, Including Building**	$527,793	$600,533	$617,448	$586,498	$607,713

THE YORK STUDY

General Description

The study shown in Tables 1 and 2 is a comparison of five different approaches to "large tonnage" water chilling. By design it is compared for air conditioning applications; however, these types of systems can be applied to a wide variety of projects in the refrigeration field. Comparisons are based on the following criteria:

1. **Cooling Duty** — 1800 tons (22,100,000 Btu per hr).
2. **Heating Duty** — 11,500,000 Btu per hr.
3. **85 F Condenser Water** — 79 F wet bulb.
4. **43 F Chilled Water** (14 F range).
5. **Gas Cost** based on Southern Union Gas rates for Austin, Texas.
6. **Electric Cost** based on City of Austin, Electric Department, Rate "D".
7. **Water available for make-up purposes** at 30¢ per 1000 gal.

This study is used for a comparison only; sufficient data included to allow calculation of the approximate operating costs of these systems in any area using established operating data and local utility rates.

These "designs" are not to be considered as exact in every detail; they are accurate, however, for estimating requirements.

Variations (5 to 30 percent) from the 1800-ton duty may be made without materially affecting this analysis. For duties above 2000 tons multiple systems with variations may be employed. Reasonably automatic operation of these systems was assumed in the design. In applying the gas turbine drive to such a system, a centrifugal compressor is connected directly to the output shaft of the turbine.

The hot combustion gases (mass flow equals 22.6 lb per second at full load) from the turbine exhaust are at a high temperature (890 F) and contain 19 percent oxygen. These gases are cooled in a waste heat boiler to generate steam (11,500,000 Btu per hr at full load) and leave the boiler at 340 F.

With the high oxygen content, refiring at efficiencies of 95 percent and above is possible. This steam may be used for operating an absorption machine, steam turbine, for process work or to heat the building. During winter operation, when only small amounts of air conditioning are required and the heat recoverable from the exhaust gases is not sufficient to heat the building, the turbine exhaust gases may be refired to add sufficient heat. Auxiliary firing apparatus in the waste heat boiler is made available for this winter refiring, and stand-by duty. With modern office buildings and factories requiring cooling and heating simultaneously during a large number of hours during the year, the gas turbine unit is highly adaptable to such buildings.

Conclusions and Analysis

Space Requirements. The space required by Systems B or C would be less than that required by any of the others.

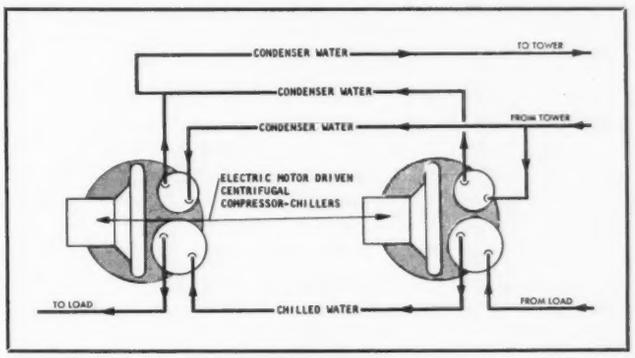
Noise. The noise level of any of these systems is comparable with that of the normal machine room. The gas turbine is quiet and may be inspected at any time.

First Cost. On the basis of first cost only, the electric drive System A is lowest, with Systems D, B, and C following closely. The prices on Systems B and C may be brought within $5000 of each other with certain equipment considerations. All prices on motors, boilers, turbines, etc. were obtained from one source and were for estimating purposes.

Operating Cost. On operating costs, System B (gas turbine and absorption) and System C (gas turbine with steam turbine) are lowest. This will hold true at 1800 tons and close thereto. However, if the system duty were increased to 2000 tons, requiring possible refiring of the waste heat boiler (at 95 percent efficiency), the operation per ton-hour of the steam turbine drive unit would be considerably less expensive. This is due to a possible water rate on the turbine of 14 to 16 lb per hr per ton in comparison with 20 lb per hr per ton on absorption systems.

Maintenance Cost. Maintenance cost on these systems is comparable. Considerable operating experience has proven the gas turbine maintenance cost should not exceed $1000 per year. All of the systems require the same number of operating personnel.

Owning Cost. The most logical "buy" would be System B or C, depending upon the actual duty requirements. The savings of $35,000 per year is an excellent return on an investment of $600,000. This analysis is based upon the assumption and data presented herein.



SYSTEM "A" ELECTRIC MOTOR DRIVE

Description

This system consists of two electric motor driven centrifugal water chilling systems employing refrigerant 12. The units are installed with the chiller water flow in series, first through a unit driven by an 800-hp induction motor and then through a unit driven by a 1000-hp induction motor. Water is to leave the last unit at 43 F. Condenser water at 85 F will be circulated in parallel through the condensers. All items as indicated in the "Installed Cost Comparison" are included in the system. The steam boiler is gas fired, 1500 MBtu per hr duty, at 12 psig steam, for winter heating. Approximate pump and cooling tower motor requirements are indicated in the operating cost analysis.

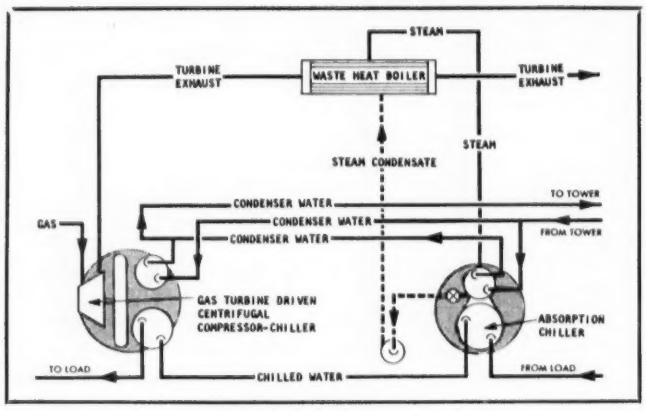
Operating Cost Analysis

This operating cost analysis was based on the following data:

(1) Water off chiller — 43 F.
(2) Centrifugal units to have capacities of 1050-tons and 750-tons.
(3) Total bhp at 100% capacity — 1875
Part load bhp at 75% capacity — 1370 bhp
Part load bhp at 50% capacity — 920 bhp
Part load bhp at 25% capacity — 500 bhp
(4) Condenser water requirement is 5400 gpm, 85 F to 95 F.
(5) Cooling tower capacity to cool 5400 gpm water from 95 F to 85 F.
(6) Approximate pump requirements:
(a) Cooling tower fan — 60 total hp
(b) Condenser water pump at 70 ft head — 120 total hp
(c) Chilled water at 90 ft head — 80 total hp

Operating cost, including electricity for main unit and auxiliaries and water for cooling tower, based on 4000 hours per year at varying capacities is:

Average cost.....$ 21.80 per hour
Total cost, cooling only.....$87,069 per year



SYSTEM "B"
GAS TURBINE DRIVE WITH LITHIUM-BROMIDE ABSORPTION

Description

This system consists of a 1200-ton centrifugal water chilling unit, using refrigerant 12, direct-connected to a Mark TA gas turbine and a 600-ton lithium bromide absorption unit operating from steam generated from the gas turbine exhaust gases. A waste heat boiler (11,500,000 Btu per hr) with auxiliary gas firing apparatus is used. The chilled water (43 F) flows through the absorption machine first and then through the centrifugal unit. Condenser water (85 F) is circulated through the two chilling units in parallel. All items as indicated in the "Installed Cost Comparison" are included in the system. The waste heat boiler is available for direct firing for heating purposes. Domestic hot water may also be obtained by adding additional surface to the waste heat boiler. Approximate pump and cooling tower motor required are indicated in the operating cost analysis.

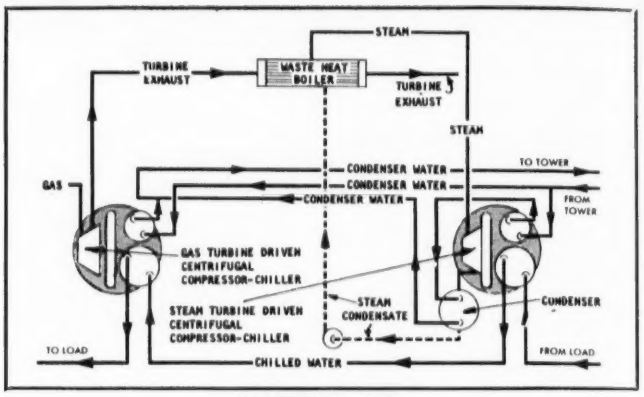
Operating Cost Analysis

This operating cost analysis was based on the following data:

(1) Water off chiller — 43 F.
(2) Centrifugal unit capacity — 1200-tons
(3) Absorption unit capacity — 600-tons
(4) Total gas requirement is 20,600 cu ft per hr of 1000 Btu gas for 1800-tons. Gas requirement at 75 percent load is 17,300 cfh for 1350-tons (both gas turbine and absorption units are on). At 50 percent capacity (900-tons) with absorption unit off and gas turbine on, gas rate is 16,200 cfh; however, 9,600,000 Btu per hr for the generation of steam or hot water is available. Gas requirement at 50 percent capacity with both units on is 14,100 cfh for 900-tons. At 25 percent load, gas requirement is 13,500 cfh for 450-tons if the turbine is used. In this case, the absorption unit operates alone at 11,800 cfh gas consumption.
(5) Condenser water requirement is 5500 gpm, 85 F to 95 F.
(6) Cooling tower capacity to cool 5500 gpm from 98.4 F to 85 F. Included are centrifugal requirements of 3600 gpm from 85 to 95 F and absorption requirements of 1900 gpm from 85 F to 105 F.
(7) Approximate electric motor requirements.
  (a) Cooling tower fan — 90 total hp
  (b) Condenser water pumps at 80 ft head — 150 total hp
  (c) Chilled water at 90 ft head — 80 total hp
  (d) Absorption pump requirements — 6 hp

Operating cost, including gas, electricity for auxiliaries, and cooling tower make-up water, based on 4000 hours per year at varying capacities is:

Average cost.....$ 10.95 per hour
Total cost, cooling only.....$43,848 per year



SYSTEM "C"
GAS TURBINE WITH STEAM TURBINE DRIVE CENTRIFUGAL WATER CHILLING SYSTEM

Description

This system consists of a 1200-ton centrifugal water chilling unit employing refrigerant 12 direct connected to a Mark TA gas turbine and a 600-ton centrifugal water chilling unit employing refrigerant 12 driven by a steam turbine. The steam for the steam turbine is generated in a waste heat boiler (11,500,000 Btu per hr), with auxiliary gas firing available, which provides 125 psig, D&S steam. The chilled water (43 F) flows through the 600-ton unit first and then through the 1200-ton unit. Condenser water is circulated through the water chilling units in parallel and then through the steam condenser. All items as indicated in the "Installed Cost Comparison" are included in the system. The waste heat boiler is available for direct firing for heating purposes, and domestic hot water also may be obtained by adding additional surface to the waste heat boiler. Approximate pump and cooling tower motor requirements are indicated in the operating cost analysis.

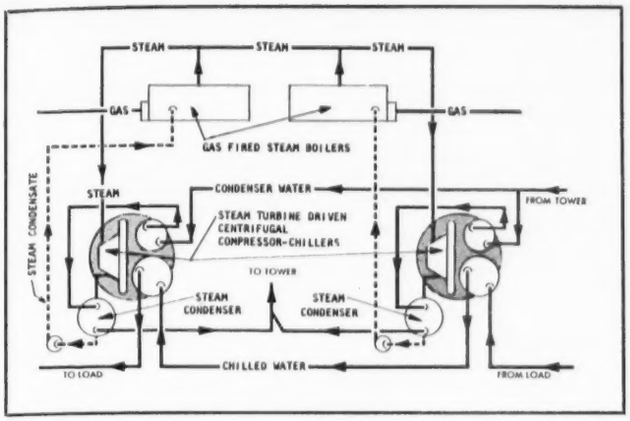
Operating Cost Analysis

This analysis was based on the following data:

(1) Water off chiller — 43 F.
(2) Gas turbine driven centrifugal unit capacity — 1200-tons.
(3) Steam turbine driven centrifugal unit capacity — 600-tons.
(4) The total gas requirement is 21,453 cfh of 1000 Btu gas for 1800-tons (full load). Gas requirement at 75 percent load (1350-tons) is 19,700 cfh with both units on. Gas requirement at 50 percent capacity with steam turbine unit off is 17,300 cfh with 1000 Btu gas; however, 9,500,000 Btu per hr are available for the generation of steam or hot water at no additional cost. The gas requirement at 25 percent load is 13,500 cfh if the gas turbine is operated; however, 5,000,000 Btu per hr are available for heating purposes. The analysis indicated the firing of the waste heat boiler and operation of the steam turbine unit alone with a total gas consumption of 11,600 cfh.
(5) Condenser water requirement is 5500 gpm, 85 F to 99.4 F.
(6) Cooling tower capacity to cool 5500 gpm from 99.4 F to 85 F. Included are requirements for water chillers and steam condenser.
(7) Approximate electric motor requirements (auxiliaries).
  (a) Cooling tower fan — 90 total hp
  (b) Condenser water pump at 85 ft head — 150 hp
  (c) Chilled water pump at 90 ft head — 80 hp

Operating cost including gas, electricity for auxiliaries and cooling tower make-up water, based on 4000 hours per year at varying capacities is:

Average cost.....$ 11.15 per hour
Total cost.....$44,601 per year



SYSTEM "D"
STEAM TURBINE DRIVE

Description

This system consists of two centrifugal water chilling units employing refrigerant 12. Each unit is driven by a 900-hp condensing steam turbine (18 lb per hr per hp water rate). Units are installed with the chilled water (43 F) in series through the chillers and with 85 F condenser water flowing in parallel through the condenser (26-in. vacuum) and two steam boilers supplying 125 psig D&S steam and rated at 17,000,000 Btu per hr output. Both supply the steam for these units and also the steam for heating purposes during the winter season. Auxiliary pump and cooling tower motor requirements are indicated in the operating cost analysis. All items as indicated in the "Installed Cost Comparison" are included in the system.

SYSTEM "D_1"

This analysis includes data for a system similar to above with 13 lb per hr per hp water rate steam turbine.

Operating Cost Analysis

This analysis was based on the following data:

(1) Water off chiller — 43 F.
(2) Centrifugal units to have capacities of 900-tons each.
(3) Total bhp of 1870 on steam turbines at water rates of 18 lb per hr per hp of 125 psig steam condensing at 26-in. Hg vacuum. Approximate gas consumption at various loads is:
  100% load — gas input — 49,500 cfh*
  75% load — gas input — 39,700 cfh
  50% load — gas input — 24,600 cfh
  25% load — gas input — 14,120 cfh
  *This rate may be reduced to 35,000 cfh at full load (part loads decrease directly) by investing an additional $60,000 in steam turbines.
(4) Condenser water requirement is 5400 gpm, 85 F to 103 F.
(5) Cooling tower capacity to cool 5400 gpm water from 103 F to 85 F.
(6) Approximate pump requirements.
  (a) Cooling tower fan — 100 total hp
  (b) Condenser water pump 90 ft head — 150 hp
  (c) Chilled water pump 90 ft head — 80 total hp

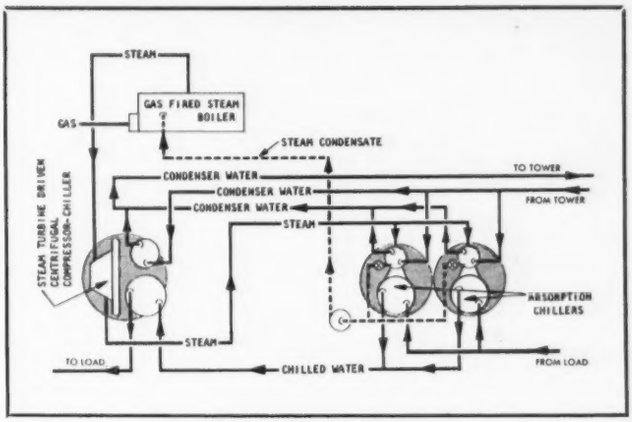
Operating cost including gas, electricity for auxiliaries and cooling tower make-up water, based on 4000 hours per year at varying capacities is:

System "D"

Average cost ..... $ 16.95 per hour
Total cost ..... $67,824 per year

System "D_1"

Average cost ..... $ 13.95 per hour
Total cost ..... $55,893 per year



SYSTEM "E"
STEAM TURBINE DRIVE WITH LITHIUM-BROMIDE ABSORPTION

Description

This system consists of a centrifugal water chilling unit, employing refrigerant 12 and driven by a non-condensing 600-hp steam turbine and two lithium-bromide absorption units. The units are arranged with the chilled water (43 F) flowing first through the two absorption units in parallel and then through the steam turbine driven unit. Condenser water at 85 F flows in parallel through each unit. Two steam boilers supplying 125 psig D&S steam and rated at 25,000,000 Btu per hr output supply steam to these units and also furnish steam for winter heating. Auxiliary pump and cooling tower motor requirements are indicated in the operating cost analysis. All items as indicated in the "Installed Cost Comparison" are included in the system.

Operating Cost Analysis

This operating cost analysis was based on the following data:

(1) Water off chiller — 43 F.
(2) Steam turbine drive unit capacity — 600-tons.
(3) Each of the two LiBr absorption units has a capacity of approximately 600-tons.
(4) The 600-hp steam turbine requires 125 psig inlet steam with 15 psig exhaust and a steam rate of 40 lb per hr per hp. Approximate gas consumption is:
  100% load — gas input — 32,200 cfh*
  75% load — gas input — 27,600 cfh
  50% load — gas input — 16,600 cfh
  25% load — gas input — 14,600 cfh*
  Boiler efficiency assumed at 75%.
  *Part of the steam supplied the absorption units is delivered by a PRV instead of from the turbine exhaust.
(5) Condenser water requirement is 6000 gpm, 85 F to 101 F.
(6) Cooling tower capacity to cool 6000 gpm water 101 F to 85 F.
(7) Approximate pump requirements.
  (a) Cooling tower fan — 110 hp total
  (b) Condenser water pump at 85 ft head 180 hp total
  (c) Chilled water pump at 90 ft head 80 hp total

Operating cost including gas, electricity for auxiliaries and cooling tower make-up water, based on 4000 hours per year at varying capacities is:

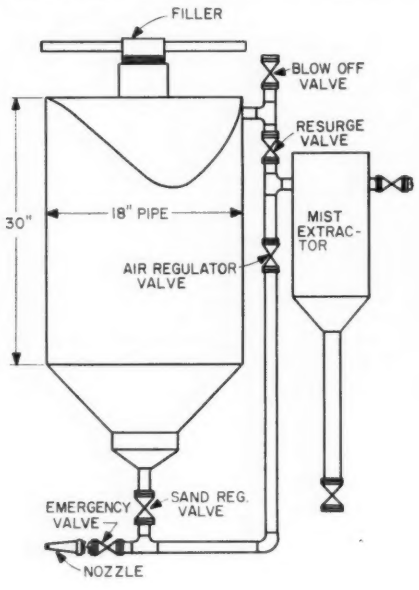
Average cost ..... $ 14.00 per hour
Total cost ..... $55,843 per year

* * *

IDEAS AT WORK

Got an idea that you think others might find useful? *It may be worth money to you!* Submit it today to AGJ's *Ideas at Work* Editor, Box 1589, Dallas 21, Texas. $10 paid for each idea accepted . . . and you can submit the same ideas submitted to your company's "idea" program. "Polished" copy and "finished" art not required. Send it to us in rough form . . . **do it today.**

Portable Sandblaster Cleans Mains in Service

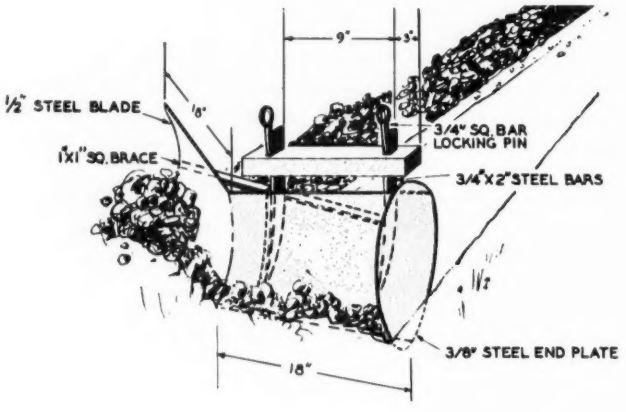


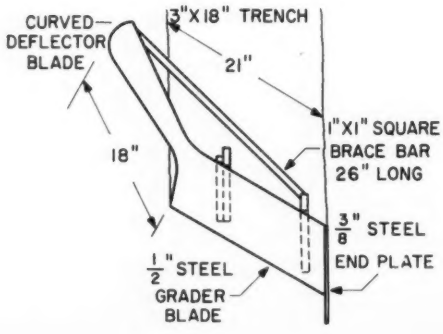
No pipe is better than its coating — and to make coating bond, the pipe must be clean. Empire Southern Gas Company, at Minden, Louisiana, is successfully cleaning large gas mains while they are in service, using the sandblaster shown in the accompanying photo. The sandblaster will clean out the deepest pits thoroughly, which hand cleaning or yard cleaning machines do not do as well. The machine is considerably faster than hand cleaning. Sandblasting also cleans out the bottom of pits, enabling the coating to fill out the thickest where it is needed most. The sandblaster is also ideal for cleaning old plug and gate valves. Average time for cleaning a 6-in. valve is four minutes. Empire Southern uses the machine mounted on a truck pulling a compressor.

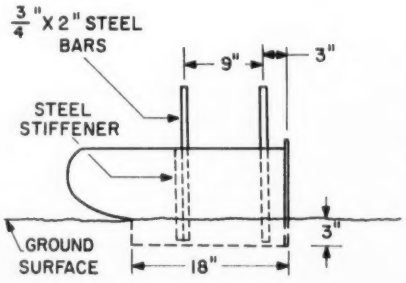
IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK

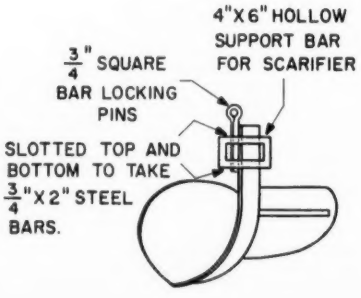
Blade for Excavating Gas Line Trench

After backfilling a trench along a paved street, it is often necessary to remove 3 to 4-in. of soil for application of pavement patching material—asphaltic concrete or portland cement concrete. This is usually done by manual labor with pick and shovel. A. C. Booth of Pacific Gas & Electric's San Joaquin Division has developed a short blade that can be attached to a jeep dozer blade, highway grader, wheel type tractor, or other equipment. The blade — made to the width of the trench — is used to strip the soil to the desired depth in one pass along the trench. Use of the tool, can effect a substantial saving in labor on such trenching operations. Plans for the blade are shown in the accompanying sketches.









IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK IDEAS AT WORK

Dust In Gas Streams

A REPORT ON SUSPENDED PARTICLES IN GAS SYSTEMS

Part 4: Theory and Operation of The A.G.A. Light Scattering Photometer

Arnold W. Doyle, John R. Ehrenfeld, and Norman W. Wiederhorn,
Arthur D. Little, Inc., Cambridge, Massachusetts

LIGHT SCATTERING BY SUSPENDED PARTICLES has been understood for many years. It has been only quite recently, however, that the principles developed by such early workers as Lord Rayleigh [1] and Gustav Mie [2] have been applied to practical instrumentation.

When a particle is illuminated by a beam of light, the particle scatters a portion of the incident light in all directions. The detailed relations that express the fraction of the light intensity scattered by spherical particles in any direction were worked out by Gustav Mie. The scattering is dependent upon the size of the particle, the wavelength of the incident light, the refractive index of the particle relative to the medium in which it is suspended, and the angle of observation.

For a very small particle, whose radius is less than about a tenth the wavelength of the incident light, scattering is proportional to the sixth power of the radius, inversely proportional to the fourth power of the wavelength of the incident light, and proportional to a factor involving the difference in the index of refraction between the particle and the medium in which it is suspended.

As the size of the particle increases, the relations for scattering become very complex. The distribution of scattered-light intensity with angle changes, and a larger fraction of the light is scattered in the forward direction, that is, in the same direction as the incident beam. For particles that are large as compared with the wavelength of the light, the total scattering is proportional to the square of the particle radius, i.e., the area of the particle.

Fig. 1 shows the intensity of light scattering by four different size particles as a function of the angle θ between the incident beam and the scattered beam. In this figure the complexity of the scattering envelope is clearly illustrated, as well as the desirability to measure the light that is scattered in the forward direction, i.e., θ is small.

Two forward-angle-scattering photometers have been designed and built for the purpose of monitoring suspensoids in gas distribution and transmission systems. One will operate at pressures up to 250 psig, the other to 1500 psi. This work was done under sponsorship of the American Gas Association on PAR projects PF-15 and NFX-12.[3]

The instruments measure the light scattered at small angles by particles in a gas stream. The basic optical design for this instrument was developed previously by LaMer and Sinclair.[4] Adaption of this design to work at elevated pressures was undertaken under the aforementioned PAR projects. The reason for choosing an instrument, which measures light scattered in the forward direction, is illustrated in Fig. 1. For small particles there is very little to choose from with regard to a preferred angle of observation. However, since for larger particles a greater portion of the scattered light is in the forward direction, greater sensitivity can be achieved by the observation of the scattered radiation at small angles from the incident beam.

Instrument Details

A schematic diagram and a photograph of the high-pressure instrument are shown in Fig. 2 and 3. Light from a source, **S** (a 50-cp automobile headlamp), is made parallel by the condensing-lens system, $\mathbf{L}_1$ and $\mathbf{L}_2$. A dark-field condensing lens, $\mathbf{L}_3$, focuses an image of the source at the diaphragm, $\mathbf{D}_1$, which is mounted at the centerline of the gas inlet and outlet tubes. An opaque patch, **P**, mounted

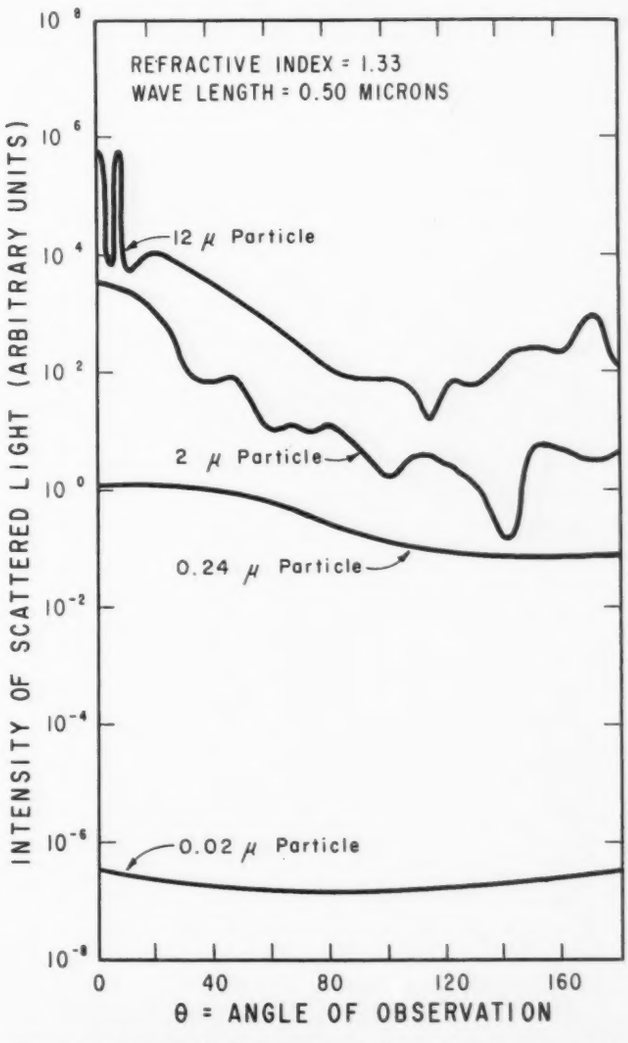


Fig. 1. Intensity of light scattering of four different size particles as a function of the angle of observation.

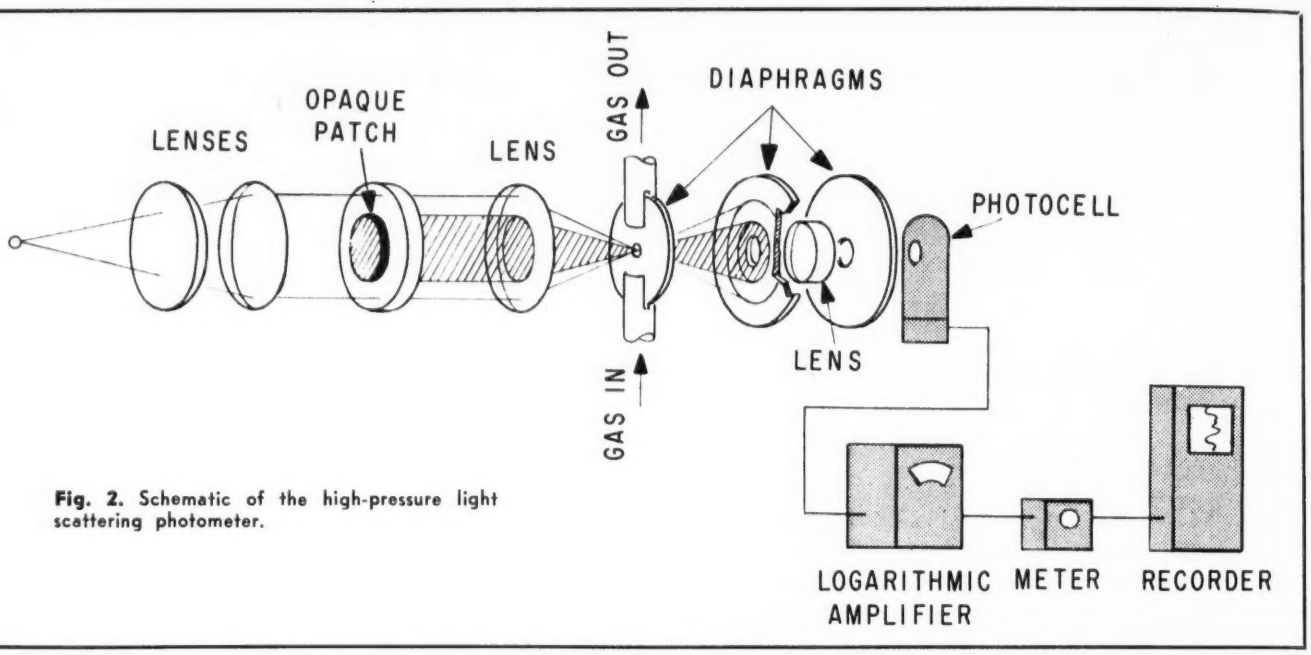


Fig. 2. Schematic of the high-pressure light scattering photometer.

concentrically with the lenses, introduces a conical black volume into the center of an illuminated volume.

Suspended particles at the focal point of the lens $\mathbf{L}_3$ scatter light into the black volume. This scattered radiation is collected by the lens $\mathbf{L}_4$ and focused on a 931A photomultiplier tube, **PH**. Two diaphragms, $\mathbf{D}_2$ and $\mathbf{D}_3$, limit the angle of observation at the photomultiplier and minimize the effect of any stray light introduced into the dark volume.

Output of the photomultiplier tube is fed through a logarithmic amplifier into a meter and a recorder. The window, $\mathbf{W}_1$, located between lenses $\mathbf{L}_2$ and $\mathbf{L}_3$, effects a gas seal at one end of the chamber. The lens $\mathbf{L}_3$ has a hole drilled through its center to equalize the pressure around it. The lens $\mathbf{L}_4$ provides the gas seal at the other end.

To reduce the pressure drop through the chamber to a minimum, the gas outlet is diametrically opposite the gas inlet. The center line of the inlet and outlet leads pass through the focal point of the optical system. The diaphragm $\mathbf{D}_1$ is located along this center line and is inserted into slots in the inlet and outlet line.

Locating the gas inlet and outlet leads directly opposite each other introduces a longer dwell time of the gas in the chamber. Consequently, very rapid fluctuations of particle concentrations cannot be observed. However, this condition is to be preferred to introducing a pressure drop across the chamber, since it has been found that very small pressure drops can initiate the formation of liquid particles. Such particles, which are in reality artifacts, could lead to entirely fallacious instrumental readings. With the present configuration, approximately one to two minutes are required to completely change the gas in the chamber at normal operating conditions (gas flow equal to 0.1 to 2.0 cu ft per min).

The photomultiplier used is a 931A with an amplification of approximately 10^6. The amplifier is a logarithmic ampli-

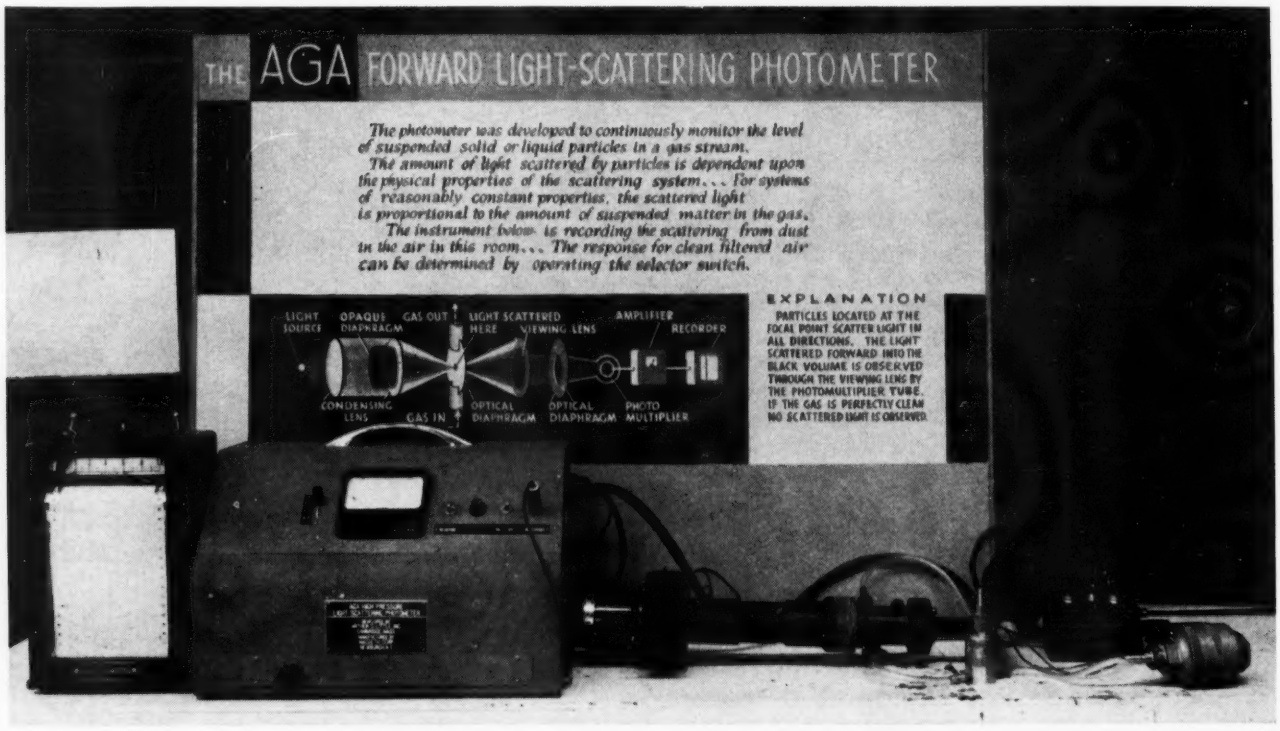

THE AGA FORWARD LIGHT-SCATTERING PHOTOMETER
The photometer was developed to continuously monitor the level of suspended solid or liquid particles in a gas stream.
The amount of light scattered by particles is dependent upon the physical properties of the scattering system... For systems of reasonably constant properties, the scattered light is proportional to the amount of suspended matter in the gas.
The instrument below is recording the scattering from dust in the air in this room... The response for clean filtered air can be determined by operating the selector switch.
LIGHT SOURCE
OPAQUE DIAPHRAGM
GAS OUT
LIGHT SCATTERED HERE
VIEWING LENS
AMPLIFIER
RECORDER
CONDENSING LENS
GAS IN
OPTICAL DIAPHRAGM
OPTICAL DIAPHRAGM
PHOTO MULTIPLIER
EXPLANATION
PARTICLES LOCATED AT THE FOCAL POINT SCATTER LIGHT IN ALL DIRECTIONS. THE LIGHT SCATTERED FORWARD INTO THE BLACK VOLUME IS OBSERVED THROUGH THE VIEWING LENS BY THE PHOTOMULTIPLIER TUBE. IF THE GAS IS PERFECTLY CLEAN NO SCATTERED LIGHT IS OBSERVED.

Fig. 3. Actual model of high-pressure unit with recorder and amplifier.

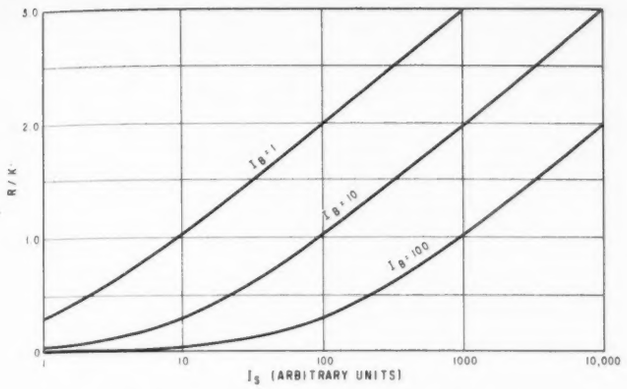


Fig. 4. Response of meter to I_S for various values of I_B.

fier covering an 8-decade range in input signal. A logarithmic amplifier was considered to be desirable because the intensity of scattered light, under conditions of high suspensoid-loading, could be expected to be several orders of magnitude higher than under normal conditions. To prevent scale-switching, which would be required with a linear amplifier, a logarithmic amplifier was adopted.

Ideally, the output signal of a logarithmic amplifier would be proportional to the logarithm of the input signal. In reality, this cannot be achieved, since when the input signal is zero the ideal logarithmic amplifier would have to read minus infinity. It has been shown [3] that the response of the logarithmic amplifier, when used to measure the intensity of scattered light, is given by the relation

$$R = K \log\left(1 + \frac{I_s}{I_B}\right) \quad . \quad . \quad . \quad . \quad (1)$$

where R is the instrument reading, I_s is the intensity of the scattered light that is picked up by the photomultiplier, and K and I_B are instrument constants. K is dependent solely upon the amplifier and may be defined as the sensitivity of the amplifier. (For values of I_s/I_B greater than about 10, K is the change in instrument reading with change in the logarithm of the scattered light intensity.)

The constant I_B depends upon both the electronics and optics of the instrument. It is the total signal reaching the amplifier when the scattered light is zero. Thus I_B is the sum of electronic noise in the amplifier and photomultiplier and the stray light that arises from imperfect optics. (Stray light is light other than scattered light that impinges upon the photomultiplier.)

It is evident from Equation 1 that the instrument reading for a given intensity of scattered light will be greater for smaller values of I_B. This is illustrated in Fig. 4, where R/K is plotted vs I_s for various values of I_B.

In this figure, it may also be seen that the response becomes sensibly linear with respect to log I_s when I_s is greater than about 10 I_B. If adequate care is taken to minimize I_B when aligning the optics of the A.G.A. photometer, then the instrument should respond in the linear region of the response curve at dust loadings that are greater than about 1 gram per million standard cubic feet.

Instrument Performance

The range of the instrument is large. Dust concentrations as low as 0.005 gms per MMscf have been detected. The upper concentration limit is about 100 lb per MMscf.

The high- and low-pressure *A.G.A. Light Scattering Photometers* have been used in a number of field operations in both high-pressure transmission and local distribution systems. The equipment has been found to be extremely helpful for purposes of monitoring dust, for obtaining information concerning oil fogging practices, for testing oil losses from oil bath scrubbers, and for checking the performance of gas cleaning equipment. Fig. 5 to 6 show installations at various gas companies. The equipment has been used successfully in the field under all weather conditions and is portable.

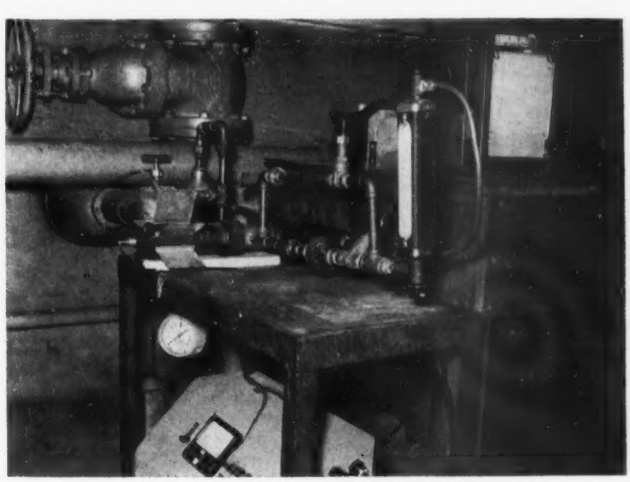
Although it is beyond the scope of this article to present all the field data that has been obtained with this equipment, some of the information is of sufficient interest to warrant discussion. In a series of tests on a high-pressure transmission line, a group of measurements concerned with the scattering of clean natural gas was made as a function of the pressure of the gas in the chamber. The purpose was to determine how the scattering changed with the pressure of the gas.

In theory, the scattering of clean natural gas should be proportional to the pressure of the gas. The reasons for this are complex. However, for a simplified interpretation of this phenomenon, each gas molecule may be considered as an individual particle that scatters a certain fraction of the light falling upon it. Thus, as the number of molecules per unit volume increases, the total scattering should increase proportionately. The number of molecules per unit volume is, of course, directly proportional to the pressure of the gas. Consequently, the amount of light which is scattered should be proportional to the pressure of the gas, and in Equation 1,

$$I_S = kP \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

or

$$R = K \log\left(1 + \frac{k}{I_B}P\right) \quad . \quad . \quad . \quad . \quad (3)$$



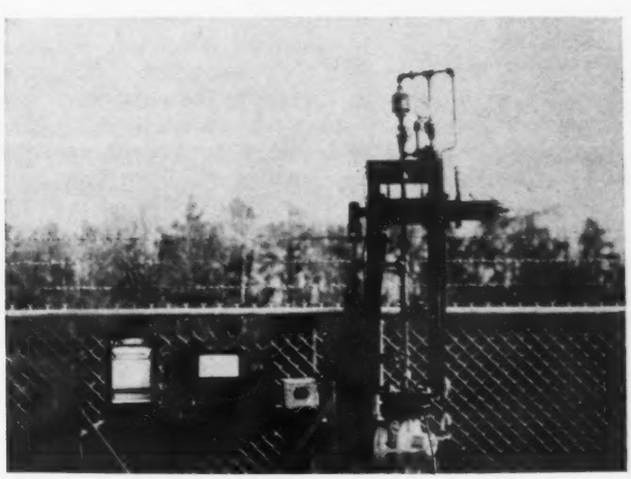


Fig. 5 and 6. Two illustrations of actual installations by different gas distribution companies.

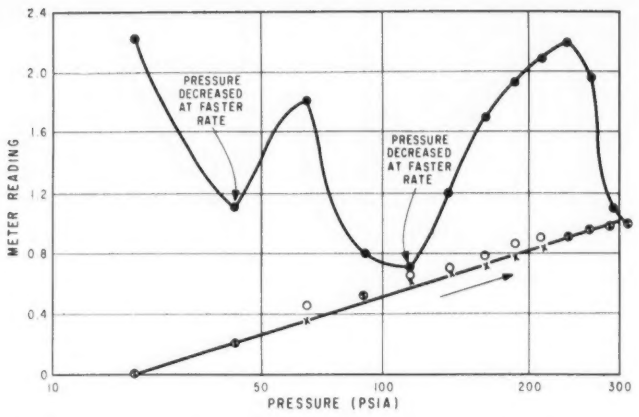


Fig. 7. Response of forward scattering photometer to changes in gas pressure.

In the initial experiments, line gas that had been filtered to remove all suspended particles was introduced slowly into the chamber by throttling the entrance valve to the chamber and closing the valve downstream from the chamber. It was impossible to obtain any meaningful results using this procedure. The readings were erratic and not reproducible. This behavior was ascribed to the formation of a liquid aerosol in the gas on the rapid expansion and cooling of the gas as it was throttled through the entrance valve. Such an aerosol presumably is composed of liquefiable hydrocarbons that are carried as vapor in the gas.

To check this interpretation of the reason for the erratic results, an absolute filter was placed in the line between the throttling valve and the scattering chamber. The filter should remove any liquid particles that formed during the throttling. The flow rate through the filter was very low so that only a negligible pressure drop would take place through it. The results now were much more meaningful and are plotted in Fig. 7. Two sets of reasonable reproducible data were taken. These are the crosses and open circles in the figure. The shape of the curve is in accord with theory (See Fig. 4), and the line drawn through this data is for $K = 0.95$ and $k/I_B = 0.025$.

When the pressure in the chamber was reduced by opening the exit valve, the reading increased sharply and then began to fall. This was due to the formation of an aerosol on expanding the gas within the chamber during the drop in pressure. The results obtained in one such set of measurements on decreasing the pressure of the gas in the chamber are also included in Fig. 7. It is not possible to obtain a reproducible set of data on dropping the pressure in the chamber since the quantity of aerosol that forms depends upon the rate at which the pressure is decreased and the concomitant extent of cooling of the gas. With the equipment that was available, it was not possible to obtain a measure of the precise quantity of aerosol that formed in the scattering chamber on decreasing the pressure. It was estimated, however, that the maximum readings obtained corresponded to a concentration of liquid aerosol of the order of 0.05 gal per million cubic feet.

It is, of course, quite well known that natural gas contains higher hydrocarbons that will condense on decreasing the temperature of the gas. However, the sensitivity of the system to the very small changes in pressure and temperature in the above measurements was rather surprising. Other observations demonstrating the sensitivity of a gas to condensation of liquid material on small changes in temperature and pressure were made in a local distribution system that was kerosine fogged. The instrument was located at a test point that was approximately 10 miles from the fogger and 100 ft downstream of a regulator.

A typical daily chart of instrument reading is shown in Fig. 8. It is interesting to note on this particular chart that at the hours when the sendout was at its maximum, the observed instrument readings were also high. The particles in the gas at this particular location were primarily liquid fog and not dust. This was demonstrated by heating the gas before it entered the chamber. When this was done, the instrument readings fell to essentially the same value as for the clean gas due to evaporation of the fog.

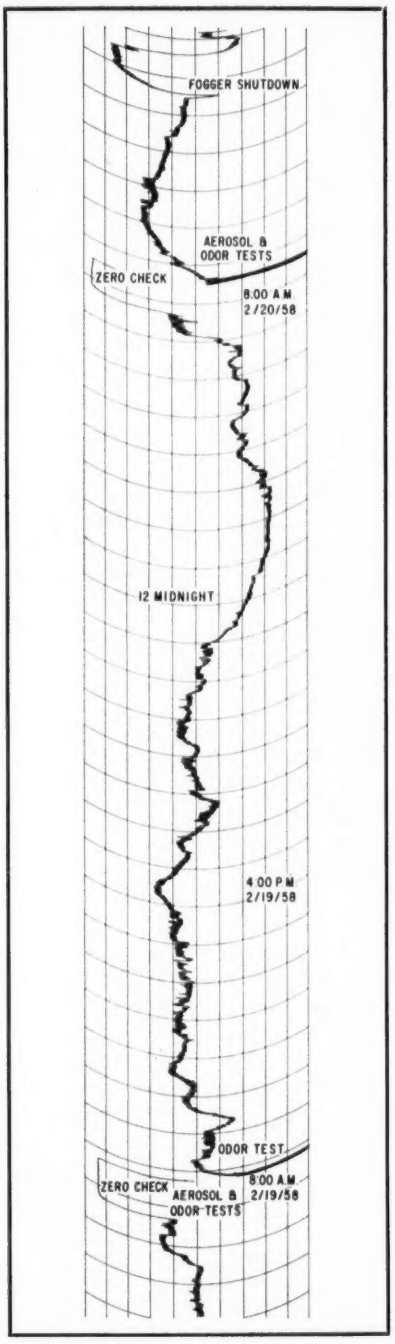


Fig. 8. Strip chart of instrument reading made on local gas distribution system that was kerosine-fogged. Instrument was at test point located 10 miles from the fogger and 100 ft downstream of a regulator. Note that at the time when sendout was at maximum, observed readings were also high.

In this particular system, the fogger is operated at a constant hourly rate, that is, the output in number of gallons per hour is maintained constant. Thus, the concentration of kerosine in the gas should be lower when the flow increases. Yet the observed readings were greater. There are two possible explanations for this behavior. During the period of

higher sendout the velocity of the gas through the main increases. The higher readings could be a result of the gas arriving at the sampling point in a shorter period of time with less opportunity for settling of the fog. This might account for an increased concentration of fogging oil at the sampling point, in spite of the fact that the actual concentration of kerosine put into the gas was somewhat lower.

On the other hand, it is also possible that when the gas passed through the regulator just upstream of the scattering chamber, the expansion and cooling of the gas caused the formation of liquid particles. This explanation would appear to be more reasonable since the relative concentrations calculated from the maximum and minimum readings is approximately 10 to 1. It is difficult to ascribe this very marked change in concentration to the shorter transit time at the higher flow rates in the gas main.

This latter conclusion was confirmed by taking absolute filter samples upstream and downstream of the regulator. When this was done it was found that there was an appreciably greater concentration of aerosol just downstream of the regulator as compared to upstream. This information is quite interesting. *It indicates that one of the mechanisms for transporting oil fog in a gas distribution system may be carrying the liquid in the vapor phase and then having it condense as it goes down the line due to cooling of the gas.*

In another application, this instrument was used for the purpose of monitoring the oil loss in an oil bath scrubber set in a high-pressure distribution system. The operating pressure in this system was approximately 450 psig. In this particular case the flow through the scrubber was varied and the instrument readings were taken. In addition, another set of measurements was made in which the amount of oil lost from the cleaner was determined by passing samples of the gas through an absolute filter.

The amount of light scattered per unit mass of material was not constant but decreased with increasing flow rate through the cleaner. From this it may be concluded that at the higher flow rates, the average size of the effluent oil also increases. This conclusion is arrived at on the following basis.

As indicated in Fig. 1, the amount of light scattered by any one particle increases as the particle size increases. However, the fraction of light that is scattered by a unit mass of particles whose size is greater than about 0.5 microns decreases as the particle size increases. (The scattering is proportional to the area of the particle.) Since this is the observed behavior in the set of data, it may be concluded that at the higher flow rate the average particle size of the suspended oil droplets increased.

The observations reported above were all with liquid particles suspended in the gas stream. In addition, the instrument has been used to monitor solid particles in gas systems. In one test, the instrument was located at a point downstream of a CCR set (continuous catalytic reforming unit for manufacturing gas) and the effluent solids from the CCR set were monitored. In another set of tests, the instrument was located in a distribution system at a point just prior to a large holder. In this particular case, the purpose was to monitor the gas coming into the holder and to make observations concerning the changing concentration of solid particulates carried in the gas. The equipment had also been employed for the purpose of following the flow pattern of gases which have been fogged with high-boiling fogging oils and to determine the concentration of fogging oils at various points within the system.

References

1. *Scientific Papers*, Lord Rayleigh, Cambridge University Press, 1899 Vol. 1 pp. 92-93.
2. G. Mie, Ann. der Phys. 25, 1908, p. 377.
3. Report of Arthur D. Little, Inc. to A.G.A. on PAR projects PF-15 and NFX-12, December 1955.
4. Sinclair, D., and LaMer, V. K., Chem. Revs. 44:245-67, April 1949.

'Free Power' From Flowing Gas Streams Provided by Steam Engine Used As Valve

DIFFERENTIAL PRESSURE IN FLOWING GAS STREAMS is being put to work, converting otherwise wasted energy into useful work and providing a new source of power for many applications. Principle of the technique, old as the water wheel, utilizes a type of steam engine.

Successful application has been made by La Gloria Oil and Gas Company at Falfurrias, Texas, where a Troy Steam Engine, manufactured by Troy Engine & Machine Company, is being used to drive a deep well water pump, operating in 24-hr a day service.

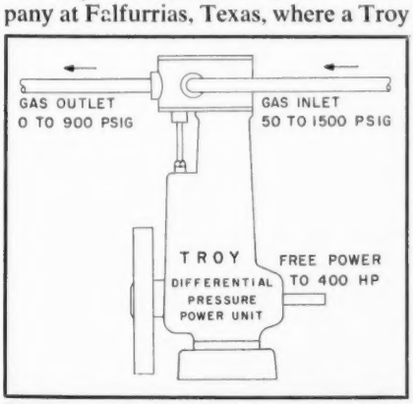


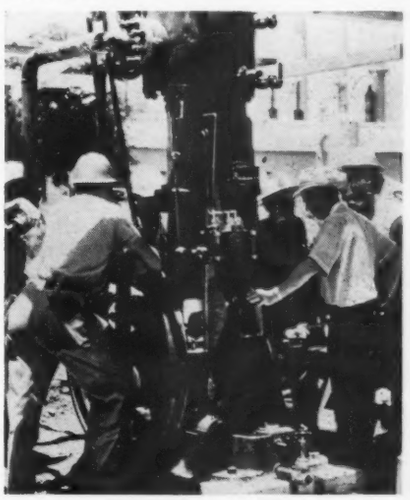
Diagram shows simplicity of operation of the pressure differential engine power plant. Inlet pressures can range from 50 to 1500 psig, outlet pressure from 0 to 900 psig, providing "free power" from 10 to 400 hp.

The engine develops 60-hp and pumps water at a rate of 500 gal per min. The Troy engine, operating on a normal steam engine cycle, is used as a pressure reducing valve between a high pressure gas dehydrator discharge line and a lower pressure feed into a field line. The pressure reduction provides the desired differential pressure or cascading action to furnish the power needed to drive the pump.

All power is provided by the gas flow through the steam engine unit, and no gas is consumed by the engine or lost to the atmosphere.

Application of the engine not only provides a source of "free power" but can be used by practically any industrial plant now using natural gas where sufficient pressure differential is available.

Possible applications seem almost unlimited — including power for driving electrical generators (for either small quantity requirements or in remote areas), driving cooling tower fans, driving air compressors for actuating air controlled instruments, driving pumps for deep well and cooling purposes, and other similar uses.



Troy steam engine, used as pressure reducing device between high pressure line and a low pressure line, develops 60-hp and is used to drive a deep water well pump at Falfurrias, Texas, from La Gloria Oil and Gas Company.

At the right, the Alsatian dog Kees sniffs along the pavement for gas in industrial areas. When he catches a whiff of the gas he stops and barks. If there is much gas he scratches with his paws over the street. At the left, Kees barks in front of an Utrecht home.

In Utrecht, Holland

Alsatian Dog Detects Gas Leaks

John Grindrod

AN employee suggestion that paid off for the City of Utrecht (Holland) Gas Authority was submitted by one of its gas-fitters — that dogs be used as gas leak detectors.

This real "gas hound" is an Alsatian dog that has been trained to successfully detect gas leaks in the city's gas mains. Of the 795 leaks detected by the dog's keen sniffer during the last six months, 63 were classified as needing speedy repair, 110 were considered as needing repair but not of an urgent nature, and 578 were hardly perceptible. A considerable decrease in gas leak detection cost resulted from the new method. Chief expenses were upkeep of the dog and wages for the average 1.5 men, contrasted with conventional methods whose costs included the wages for five gangs of four men each.

In March 1955, training began with a two-year-old Alsatian dog named Kees. At first, he received the same training as a police dog. After two months, special training began. A cloth with a strong smell of gas was buried in the sand and the dog was taught to find where the cloth was hidden. At this time, too, Kees got his own master.

During training, several kinds of gas were used. After an additional three months' training, Kees was appointed to the staff of the Utrecht gasworks.

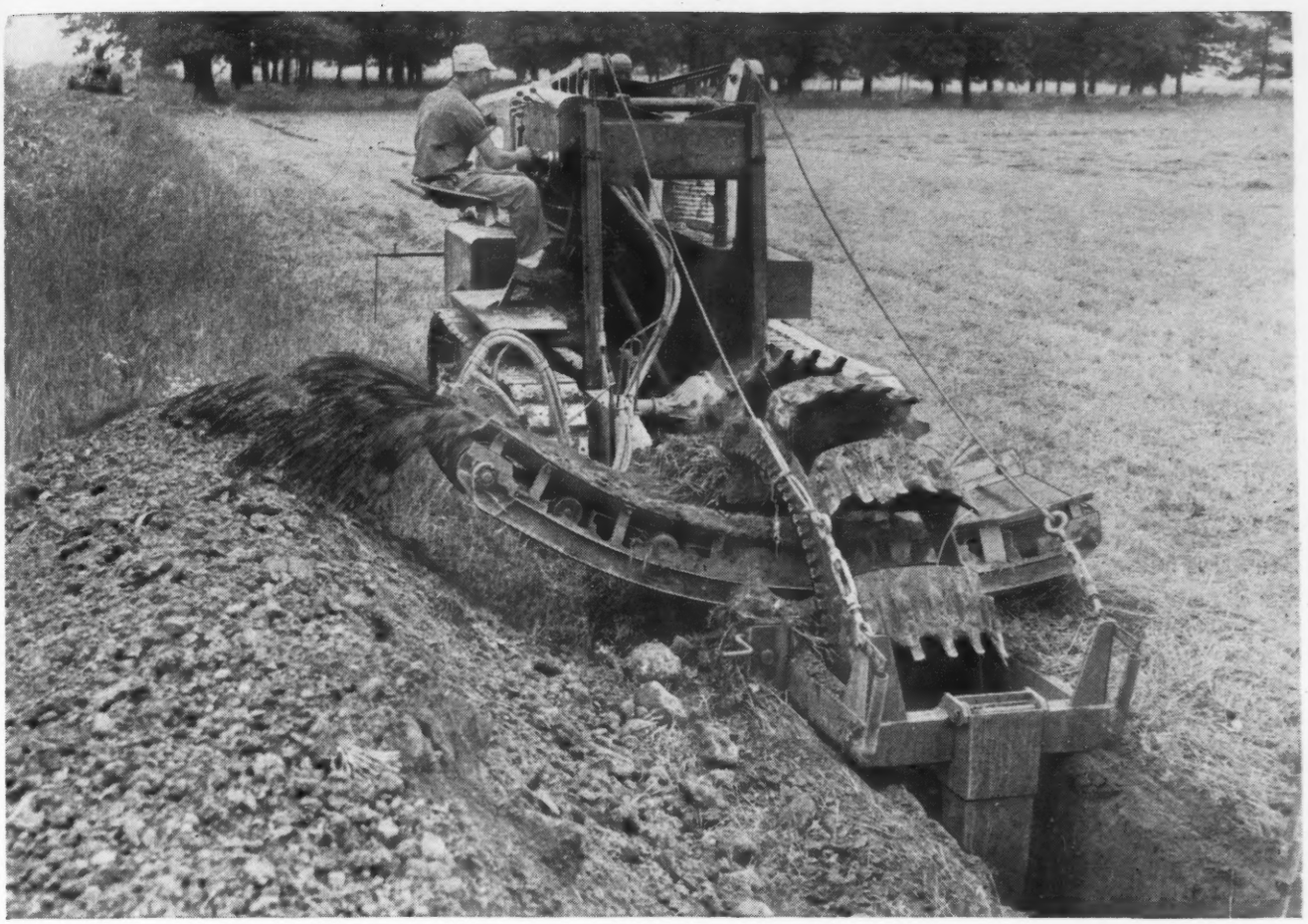
Kees' unique gas sniffing method is to lie down on the street in the direction of the gas main. His leader puts the collar around his neck and fixes a long line. Then, on the command "seek," the dog runs along the street with its nose over the pavement. Where he observes a smell of gas, he stops and barks. If there is very much gas, he scratches with his paw over the street. In this way, his leader has a rough indication whether he has to take measures for a rapid repair or not.

Kees has to have quiet, so he begins work very early in the morning before people and traffic have started to move, usually from about 4 to 8 a.m.

Kees usually manages to cover one kilometer per hour. At this rate, it takes about six months for inspection of the entire gas main network in the city of Utrecht and the surrounding villages. The total length of gas main inspected is 525 kilometers.

The conventional method used by the city's gas utility for detecting gas leaks is to make a small hole in the ground every two meters above the gas main. The air in the hole is then examined by means of a "Vulkan" gas detector of the "diffuse-method-type." To prove the keenness of Kees' nose, all the spots pointed out by the dog are re-examined by the Vulkan detector. When the apparatus registers more than 10 on its scale, the leak is classified as "Category A," for which a speedy repair is considered necessary; between 5 and 10, as "Category B," where a repair is thought desirable but not urgent; and below 5, "Category C," a leak hardly perceptible when the surrounding ground is of sand. Clay, however, gives a different result and in that soil it is advisable to dig out the ground, even where the registration is zero.

On several occasions, Kees has diverted from his straight path over the main and crossed to a house barking furiously. On investigation, a leak has been discovered, in the meter, the head cock or the tap of the gas cooker in the kitchen. On one occasion, the service pipe near the wall was found to be broken. * * *



Barber-Greene Model 774 Wheel Ditcher—with its many new, exclusive advantages—digs accurately to grade as it sets production records on new superhighway drainage ditch. Write for new bulletin.

Why this rugged Barber-Greene digs up to 25% more trench per day

These exclusive Barber-Greene advantages enable the Model 774 Wheel Ditcher to produce up to 25% more ditch per day than any machine of its size:

- **New Dual Range Hydra-Crowd Transmission** provides infinitely variable crowding speeds independent of wheel and conveyor drives. No stopping to change speeds . . . no gear shifting. Instant selection of maximum crowding speeds for every digging condition.
- **New Flexible Drawbar** between chassis and boom reduces transfer of twist and tilt from wheel to chassis when digging around curves or over uneven ground. Reduces wear and maintenance.
- **New Digging Wheel Drive** through telescoping drive shaft, floating differential and split No. 1 shaft cuts maintenance and wear on drive unit . . . assures balanced torque and constant contact on both sides of the digging wheel.
- **New All-Hydraulic Spoil Conveyor Drive** provides instant selection of infinitely variable speeds up to 630 fpm., independent of wheel speed . . . instant reverse. Spoil placed at desired distance from trench.
- **New Hydraulic Controls** give greatest accuracy in digging to line and grade . . . offer a new high in operating ease. Entire control panel, with all controls in easy reach, results in less fatigue and greater operator comfort.

Other exclusive Barber-Greene features

New crawler design; new automatic electric overload protection; new hydraulic brakes; new hydraulic boom hoist; readily convertible to vertical boom ditcher.

58-11-D

Write for information on the ditcher line of advanced design.

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

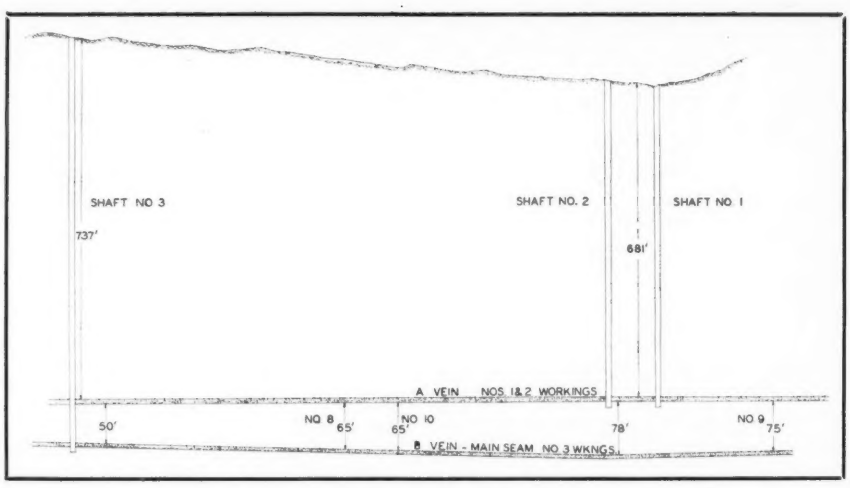


Fig. 1. Cross section of Leyden Mine.

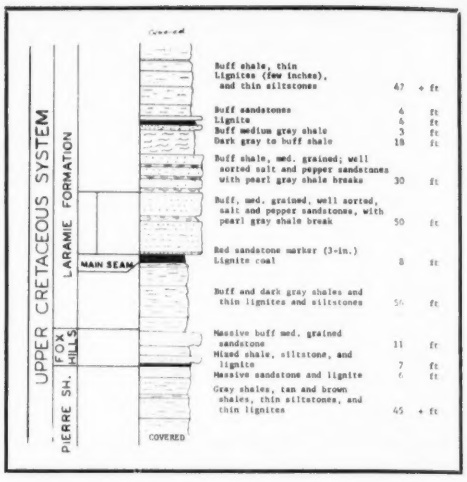

UPPER CRETACEOUS SYSTEM
LARAMIE FORMATION
FOX HILLS
PIERRE SH.
MAIN SEAM
COVERED
Buff shale, thin Lignites (few inches), and thin siltstones 47 + ft
Buff sandstones 4 ft
Lignite 6 ft
Buff medium gray shale 3 ft
Dark gray to buff shale 18 ft
Buff shale, med. grained; well sorted salt and pepper sandstones with pearl gray shale breaks 30 ft
Buff, med. grained, well sorted, salt and pepper sandstone, with pearl gray shale break 50 ft
Red sandstone marker (3-in.)
Lignite coal 8 ft
Buff and dark gray shales and thin lignites and siltstones 56 ft
Massive buff med. grained sandstone 11 ft
Mixed shale, siltstone, and lignite 7 ft
Massive sandstone and lignite 6 ft
Gray shales, tan and brown shales, thin siltstones, and thin lignites 45 + ft

Fig. 2. Geological structure of lower Leyden Mine area.

In Colorado, work is underway to determine if it's practical to use a . . .

Coal Mine To Store Gas!

CONVERSION OF A COLORADO coal mine to a storage vault for natural gas is being undertaken for the first time anywhere in the world by Public Service Company of Colorado.

Intensive testing operations are currently underway at the Leyden Lignite Mine, seven miles northwest of Arvada, to determine if the mine is gas tight. Use of the mine for storage purposes has been studied for the past three years. If the current tests reveal that the mine is a suitable container for gas, the cavern will be developed as a permanent storage for natural gas to be used for peak shaving in the heating season, a move that will greatly relieve the Denver area's present gas supply problem.

From 1903 to 1950, when the Leyden mine was abandoned, approximately 6,000,000 tons of coal were mined, leaving a cavern having a volume of nearly 150,000,000 cu ft. An estimated 3-billion cu ft of natural gas could be stored in the old mine cavern at a pressure of 300 psi.

The mine is now nearly filled with water. Because the core seam slopes downward some 200 ft from north to south, it is possible that a pocket of trapped air may now exist above the water level in the north end of the mine. If such an air pocket is found, it will be an indication of tightness of the cavern.

Gas under pressure is to be injected through a 975-ft well drilled into this north end of the cavern. The first attempt at drilling an injection well was unsuccessful, and a second well at another location is in progress. As the test

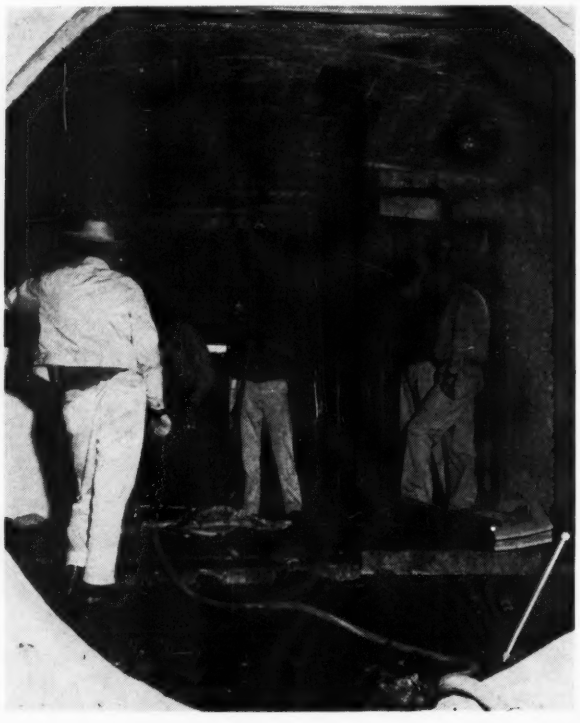


Fig. 3. Cement cap sealing the top of one of the shafts to the abandoned Leyden coal mine is broken open in order to test the water level in the mine. Since the mine discontinued operations in 1950, the cavern has filled with water.

Fig. 4. Steel reinforcing bars had to be removed by engineers attempting to re-open one of the Leyden coal mine's sealed shafts. Through this opening the engineers lowered instruments to measure the water level in the abandoned mine during injection of gas to test its fitness as storage vault.

Fig. 5. Testing operations on the Leyden coal mine, 15 miles northwest of Denver, began with erection of a drilling rig, which will penetrate to the mine some 975 ft below. Through this well, gas will be injected in order to test the tightness of the mine for gas storage.

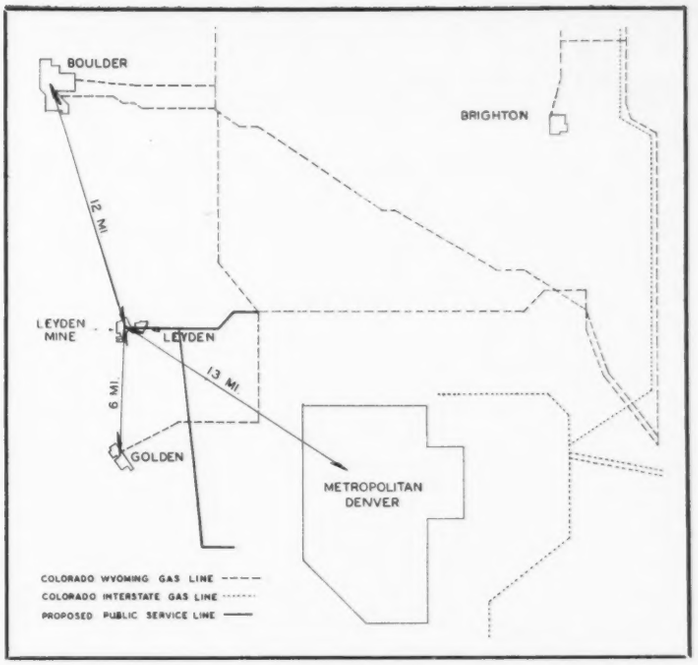


Fig. 6. Map shows location of Leyden Mine area in relation to Denver, lines of its suppliers, and route of proposed Public Service Company line from metropolitan Denver to the gas storage area at the mine.

progresses, additional volumes of gas will be injected, forcing water out of the mine back into its source or to the surface through another well to be drilled into the low, south end of the mine. An estimated 1.3 billion cu ft of gas at 130 psi will be needed to hold back the flow of water into the mine, once the water now present is pumped out.

By mid-June, construction was completed on an 8-mile gas line from 88th and Carr Streets in Denver to the mine site. The last 3 miles of the line is to be a temporary installation. Public Service Company will then begin injecting some 115,000,000 cu ft of gas into the northern end of the mine. If that portion of the mine is found to be gas tight, the mine's four shafts will be sealed and the rest of the mine filled with gas to test the entire vault for storage.

Rock cores taken during drilling of the first well and other preliminary investigation indicates that the rock strata above and below the coal seam should form a gas-tight seal. It is possible, however, that porosity in the rock strata or the coal seam may permit gas to escape. If such is the case, silicon tetrachloride gas will be injected into the mine. This gas has an affinity for water and water vapor, and will build up a deposit of water glass on the grains, gradually plugging the porous sand.

In the event the entire cavern is found to be gas tight, development of the mine as a storage vault will begin immediately. Four additional wells will be drilled into the mine for injecting and withdrawing gas.

The 5-mile section of the gas delivery line leading to the mine from a high-pressure line at 88th and Carr Streets in Denver will be permanently installed. Should the tests reveal the storage project to be unfeasible, the 3-mile temporary section of the line will be removed and salvaged, and the permanent installation will be converted to another use.

This line will have a daily capacity of 60,000,000 cu ft of gas. Another 22-in. line, with 150,000,000 cu ft daily deliverability, will be constructed from the mine to meet Public Service Company's distribution system at Jewell and Alkire Streets.

In addition, gas compression facilities rated at 11,320-hp, as well as facilities for regulating, metering, and dehydrating the storage gas will be constructed. Dehydration will be necessary because gas stored in the mine will pick up moisture that will have to be removed before it is put into the distribution system.

Public Service Company officials estimate that the test phase of the operation will cost approximately $352,000. If initial tests prove satisfactory, the developmental stage will require an additional expenditure of an estimated $5,217,000. An estimated five years will be needed to complete the project, although it is possible that storage can begin in time for the 1959-1960 heating season. * * *

Fig. 7. Construction on 8-mile high-pressure gas main leading to new underground gas storage project. With daily capacity of 60,000,000 cu ft, this 18-in. main is one of two lines to be constructed, if tests prove coal mine can serve as storage vault.

NEWSREEL

MORE THAN 33,000 additional space-heating customers will be added by 14 natural gas distribution companies as the result of the FPC's recent directive to Michigan Wisconsin Pipe Line Co. of Detroit, Michigan. The commission modified a decision by one of its presiding examiners noting that "orderly development of the market require some additions should be permitted based on 1959 estimates for each of the distributors." Each distributor was allotted sufficient additional permits to enable each to attach a minimum of one-half the number estimated for 1959. Companies involved and the number of space heating customers allotted were: Michigan Gas and Electric Co., 996; Michigan Gas Utilities Co., 1468; Milwaukee Gas Light Co., 15,454; Wisconsin Natural Gas Co., 6100; Madison Gas and Electric Co., 597; Wisconsin Power and Light Co., 2684; Wisconsin Public Service Corp., 3863; Wisconsin Michigan Power Co., 438; Wisconsin Fuel and Light Co., 350; Stoughton Light and Fuel Co., 43; Illinois Power Co., 7; Iowa Southern Utilities Co., 568; and St. Joseph Light and Power Co., 385. Michigan Wisconsin is also to deliver 58,049,000 cu ft annually to Northern Illinois Gas Co. for resale in Earlville, Illinois, to a limited 227 space-heating attachments.

MICHIGAN CONSOLIDATED GAS COMPANY'S "hot water" car card advertisement has been selected as the National Association of Transportation Advertising's "Car Card of the Year" by a panel of agency heads. Car card ads of Bank of America, Life Savers, and Pepsi-Cola rated honorable mention from the more than 600 cards entered in the annual competition. Winning car card was prepared by Cramer-Krasselt Company, Milwaukee advertising agency, and is one of a series prepared for the American Gas Association and offered to gas companies throughout the country.

THREE UTILITIES will be able to add approximately 135,000 new house heating customers in the Chicagoland area as new sources of natural gas become available under FPC's recent approval of Midwestern Gas Transmission Company's $50,000,000 application to deliver 360,000,000 cu ft daily within the next three years. Northern Illinois Gas Company, slated to receive 60,000,000 cu ft per day will be able to substantially clean up its 60000 house-heating waiting list. Company recently mailed space heating permits to 41,500 customers when Northern Natural Gas Company received FPC permission to supply NI with an additional 50,000,000 cu ft per day later in the year. Northern Indiana Public Service Company, to receive 200,000,000 cu ft per day, will be able to supply 25,000 customers waiting for house heating and connect up to 45,000 new home heating customers in the next three years. Peoples Gas Light and Coke Company's additional 100,000,000 cu ft per day will permit addition of about 30,000 space heating customers this year. A connecting link, estimated to cost $12,900,000, will be built by Chicago District Pipeline Company, subsidiary of Peoples Gas to bring the gas from a point near Joliet, Illinois, on the Midwestern line to connections with the three distribution companies.

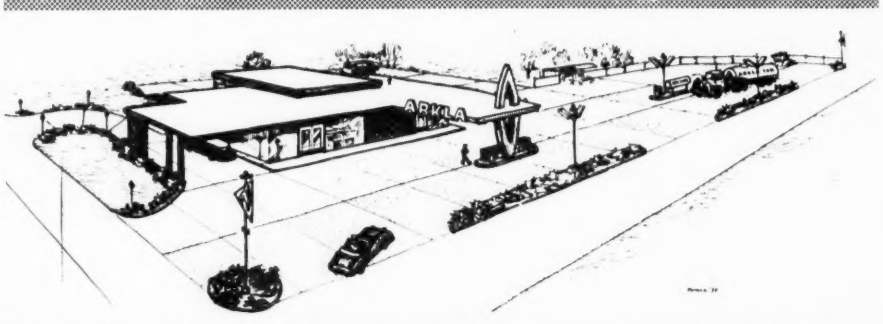
EL PASO NATURAL GAS COMPANY will supply Southern California Edison Company with a maximum 100,000,000 cu ft per day for use in its steam electric generating plants in Los Angeles if decision of FPC examiner Binder stands review by the commission. Involved is construction of $24,000,000 in pipeline facilities to enable El Paso to deliver gas to Southern California gas companies near Topock, Arizona, or Blythe, California, for the account of Southern California Edison. **Examiner's decision was based on the air pollution problem in Los Angeles, and he noted that use of natural gas as boiler fuel in this area should be considered as being in "a different category" than gas being used for such a purpose in other communities where the smog problem does not exist.**

NEW GAS REFRIGERATOR manufactured by Kirk Industries, Inc. has been tested and approved by the A.G.A. Laboratories, and is now avaliable to gas utility companies. The new 10.2 cu ft refrigerator features "Polar-Temp" freezing compartment that holds 34 lb of frozen food, full-width vegetable crisper, and a 12-way temperature control.

ALLIS-CHALMERS MANUFACTURING COMPANY has announced plans to acquire Tractomotive Corporation, Deerfield, Illinois, through an exchange of stock. Tractomotive manufactures a rubber-tired wheel loader called the "Tractoloader," which is now sold through A-C construction machinery dealers. These units, equipped with shovels range in weight from 6000 to 23,000 lb. Company also manufactures front end shovels, rippers, and side booms for pipelaying. Plans are for Tractomotive to become part of Allis-Chalmers' construction machinery division and complement production at firm's Springfield, Illinois, and Cedar Rapids, Iowa, plants.

OVERALL THEME of "New Horizons for Growth and Service" has been selected for the American Gas Association's 1959 annual convention to be held October 5-7 at the Conrad Hilton Hotel in Chicago. Eskil I. Bjork, chairman of The Peoples Gas Light and Coke Company, and J. J. Hedrick, vice chairman of the board of the Natural Gas Pipeline Co. of America — co-chairmen of the A.G.A. general convention committee—have announced an impressive list of speakers for the annual convention, headed by Erwin Canham, president, U. S. Chamber of Commerce, and editor of one of world's leading newspapers, *The Christian Science Monitor*. General sessions will explore new horizons for gas, finance, economics, management, legislation, energy, gas supply, and sales. Tying in with the convention theme will be a panoramic outdoor exhibit and demonstration of heavy-duty equipment conducted by the A.G.A. operating section titled "New Tools for Growth and Service." Exhibit will feature newest, most advanced types of equipment used in construction, operation, and maintenance of gas industry facilities. Exhibit area — 9 miles from downtown Chicago—will cover 10 acres; demonstrations will be conducted the second afternoon of the 3-day meeting. Limited to self-powered, self-contained, mobile equipment used in all phases of gas industry operations, the exhibit will include trucks, tractors, trenchers, borers, pipewrappers, portable compressors and generators, lifts, hoists and cranes, drilling rigs, hydraulic hammers, earth movers, derricks, backhoes, loaders and diggers.

MERGER of The Aerotec Corporation, Prat-Daniel Corporation, Aerotherm Corporation, and Thermix Corporation has been approved by the stockholders and the new corporation will be called Aerotec Industries, Inc. The three main product groups will be handled by separate divisions. The Industrial Division that designs and manufactures dust collectors, or gas scrubbers, electrical precipitators, curtain dampers, blowers, fans, and other heavy industrial products will continue operations at both the Prat-Daniel plant in South Norwalk and in Greenwich. Officers of the new corporation are: Louis C. Whiton, chairman of the board and John E. Watson, president.



Construction of the first Arkla Service Centers, retail gasoline and motor fuel stations, and newest enterprise of Arkansas Louisiana Chemical Corporation, a subsidiary of Arkansas Louisiana Gas Company, has begun at El Dorado, Arkansas, and is scheduled for completion by late summer. More centers are scheduled to be built soon at Little Rock, Russellville, Texarkana, and Magnolia in Arkansas, Shreveport and Bossier City in Louisiana, and Pittsburg and Jefferson in Texas. New stations will market a complete line of motor fuels under the brand name "Arktane" in addition to motor oils and other automotive accessories. Each station will have a display room containing other products manufactured by ALG subsidiaries, including Gaslites, horse-drawn carriages, Razorback boats, gas air conditioners, and other gas appliances. W. R. Stephens, president of parent company Arkansas Louisiana Gas Company, stated that where feasible, service centers would have drive-in windows with full time attendant where gas company customers will be able to pay monthly bills and apply for gas service.

APPROXIMATELY 4,000,000 NEW GAS HOUSEHEATING CUSTOMERS will be added during the next three heating seasons, American Gas Association estimates. New homes are expected to account for 2,300,000 or nearly 60 percent, while conversions from other fuels will account for the remaining 1,700,000. These new figures represent dwelling units rather than units of gas heating equipment. Gas now heats more than 19,000,000 homes, a gain of 6 percent over 1958, reports the A.G.A. gas utility companies added 1,079,000 new residential heating customers in 1958. Nearly 65 percent of all residential gas customers now heat their homes with gas, a gain of 2.3 percent from the 62.6 percent a year ago. More than 25 percent of the new heating customers to be added during the next 3 years will be located in the East North Central area where a whopping 1,100,000 new installations are anticipated. Included in this area are Illinois, Indiana, Ohio, and Wisconsin. Second ranking in growth will be the Pacific region covering California, Oregon, and Washington with an estimated 628,000 additions. Middle Atlantic states of New York, New Jersey, and Pennsylvania will add 526,000 new heating customers by end of 1961-62 season. South Atlantic area has moved into fourth place among regions where gas use will be growing. New heating equipment market is being established in Florida where heavily populated areas are now beginning to receive natural gas for the first time. From an approximate 105,000 gas heating customers now in Florida, an estimated 148,000 new heating customers will be added during the next three years.

R. H. Lussky

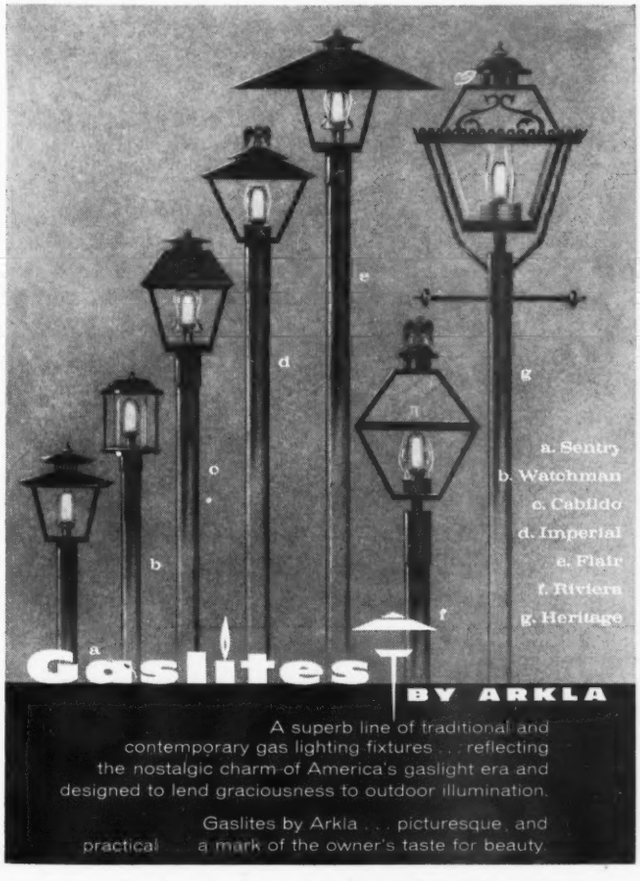
C. D. Rader

RECORD ATTENDANCE EXPECTED, at gas measurement short course. Approximately 800 gas utility measurement and control engineers and technical personnel are expected to attend the 19th annual Appalachian Gas Measurement Short Course, August 24-26 at West Virginia University, Morgantown, West Virginia. According to R. H. Lussky of the West Virginia Public Service Commission and short course program chairman, some 90 classroom, laboratory, and forum sessions have been scheduled, with the sessions ranging from basic courses through shop practice and testing, installation design, monitoring equipment, and other related phases of regulation and measurement. In addition to classroom sessions, latest developments in the field of natural gas measurement and control equipment will be displayed. More than 50 leading gas equipment manufacturers will have exhibits. Carl D. Rader, Tennessee Gas Company, Columbia, Tennessee, and general chairman of the course officially opens the school at the general assembly August 24.

ROYSTON LABORATORIES, INC. of Pittsburgh, Pennsylvania, manufacturers of corrosion resistant coatings, has opened a new sales office in St. Petersburg, Florida, and warehousing facilities in Tampa, Florida. Murray Newell is the new sales representative for Florida, southern Alabama and southern Georgia.

SOUTHERN PIPE DIVISION of U. S. Industries, Inc. of Azusa, California, has begun construction of a steel pipe fabricating and processing plant in the Hawaiian Islands. George F. Yackey, for 12 years manager of the Fallbrook, California, Public Utility District, has been named project manager for the construction program. The new plant is located on a 4-acre plot in the Campbell Estates Industrial Tract at Barbers Point on the south coast of the Island of Oahu, west of Pearl Harbor. First pipe from plant is scheduled for delivery in August.

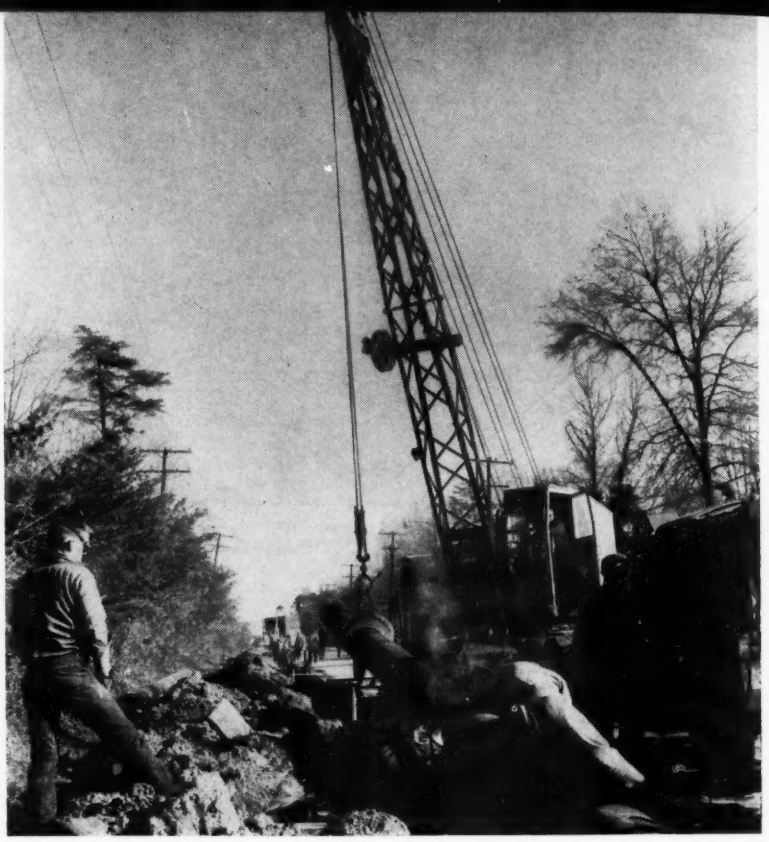
ENTERPRISING TEXANS have formed a gas distribution company for the Anchorage, Alaska, area and propose to distribute gas for domestic, commercial, and industrial usage in the new state. Headed by Robert B. Baldwin as president, the Anchorage Gas Corporation has been incorporated in Alaska, and a franchise has already been approved by the city council of Anchorage. Officers of the corporation, in addition to Baldwin, are Horace B. Webb, vice president; Frank Chilson, vice president; D. N. Barrow, vice president; William C. Smith Jr., treasurer, and S. Eastland Jr., secretary, and Paul F. Robinson, general counsel. All are Houstonians except Robinson who is a resident of Alaska. Construction of distribution and storage facilities will begin as soon as necessary market surveys are completed. Much of the fuel needs of Anchorage are presently met by fuel oil.


a. Sentry
b. Watchman
c. Cabildo
d. Imperial
e. Flair
f. Riviera
g. Heritage
Gaslites BY ARKLA
A superb line of traditional and contemporary gas lighting fixtures . . . reflecting the nostalgic charm of America's gaslight era and designed to lend graciousness to outdoor illumination.
Gaslites by Arkla . . . picturesque, and practical a mark of the owner's taste for beauty.

For full specifications and prices, please write
Arkla • Gaslite Division • Shannon Building • Little Rock, Arkansas

DESTINATION: TOMORROW!
TODAY THE E/4 SHOULDER HOLIDAY DETECTOR AND THE E/P PULSE TYPE DETECTOR FOR DAMP CLIMATES ARE ANSWERING THE PIPELINER'S NEED FOR A DEPENDABLE, FULLY PORTABLE, GENERAL PURPOSE ELECTRICAL INSPECTION INSTRUMENT.
BOTH MODELS CAN BE USED FOR A FULL DAY WITHOUT RECHARGING THE BATTERY. ALL WRAPPED SURFACES INCLUDING PIPE CAN BE QUICKLY AND ACCURATELY INSPECTED FOR VOIDS, PINHOLES, BREAKS, SCRATCHES AND BURNED OR COKED SPOTS
MODEL E P
TOMORROW THESE SAME DETECTORS WILL BE USED IN THE INSPECTION OF TUBING ON OUTER SPACE ROCKETS. FOR TINKER & RASOR DETECTORS ARE DESIGNED FOR THE FUTURE!
DISTRIBUTORS
Crutcher-Rolfs-Cummings Inc. Houston, Texas
Remco Manufacturing Co., Inc. Tulsa, Oklahoma
Canadian Equipment Sales & Service Ltd. Edmonton, Alberta, Canada
Bob Herrick Rentals & Service Harrisburg, Penna.
Falcon Line Products Corp. Elizabeth, N.J.
Export Agents . . . Frazer & Hansen Ltd. San Francisco, Calif.
Electronic Detectors for every Industry
TINKER & RASOR
417 AGOSTINO ROAD, P. O. BOX 281, SAN GABRIEL CALIFORNIA

Consolidated Edison of New York is making preparation for the direct tie-in in the vicinity of 72nd Street with Transcontinental Gas Pipe Line's third link with the New York market. The new Transco dual line, to stretch from North Bergen, New Jersey, across the Hudson River, to 72nd Street, Manhattan Island, is now being laid as part of Transco's new $115,000,000 construction program to increase New York deliveries by approximately 106,000,000 cu ft or 35 percent. The Transco installation marks the first time that two parallel pipelines have been pulled simultaneously across a major river. Prime contractors for the new crossing are Samuel Gallucci & Sons, and Collins Construction Company, specialists in underwater pipeline construction. The new line will be Transco's third underwater crossing connecting with the metropolitan area. First crossing at 134th Street, Manhattan, was completed in 1950. A second crossing under The Narrows of New York Harbor from Staten Island to Brooklyn was completed in 1952. ConEd had budgeted approximately $6,100,000 for all new construction on its gas distribution system in 1959.



Welders add joint of 16-in. pipe to new main recently installed near Greenbelt, Maryland, by Washington Gas Light Company. Job was part of a 31,750-ft mains extension project to supply new customers on company's lines in Maryland, included one section of 7200 ft of 16-in. and more than 24,000 ft of 2, 4, and 8-in. mains.

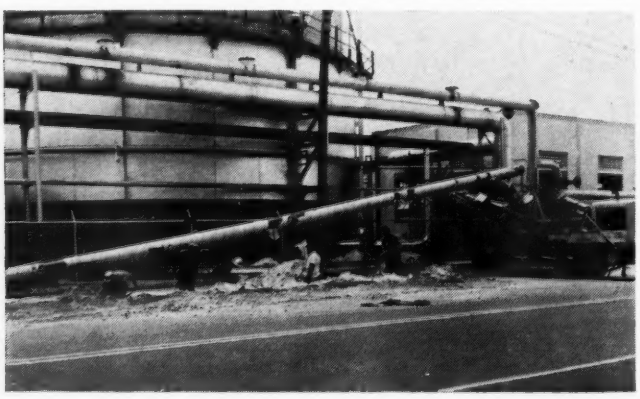
DISTRIBUTION DEVELOPMENTS

NEWS ABOUT CURRENT AND PLANNED CONSTRUCTION

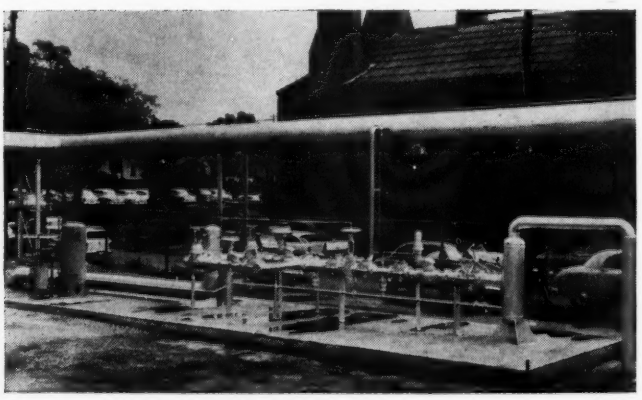
Inter-City Gas Ltd., Winnipeg, Manitoba, completed in 1958 installation of 100,000 ft of distribution mains to supply 1278 new customers on the company's system. Conversion of 650 buildings to natural gas has also been accomplished. A 23-mile supply line from the Trans-Canada line to Camp Shilo laid at a cost of $252,815 has also been completed.

British Columbia Electric Company, Vancouver, British Columbia, has just completed installation of 2500 ft of 20-in. main in a $300,000 underwater crossing of the Fraser River near Tilbury Island. Contractor was Marine Pipeline and Dredging Ltd. Project is part of B.C.'s $4,000,000 95,000 ft line to supply the west side of metropolitan Vancouver. Scheduled for completion by this fall, the line — a third supply line to the city — will run from the main gas transmission line in Surrey, down the south bank of the Fraser and across the south arm of the river, near Tilbury Island, through Richmond, under the north arm of the Fraser and to a new pressure reduction station to be built in South Vancouver. Completion of the line will bring first gas delivery to West Delta and Ladner.

Final link between new natural gas line in Florida's Sunshine Parkway and Peoples Gas System's gas manufacturing plant in North Miami Beach is section of 12-in. (below, left). In June, natural gas began flowing into the plant, from where it is distributed to Dade County to the south and Broward County to the north. The 12-in. line supplies twice as much gas as manufacturing capacity of the plant.



First natural gas regulator station in St. Petersburg, Florida, (below, right) operated by the city's gas department, also went into operation in June. Station reduces gas pressure from pounds to inches for distribution to St. Petersburg area customers, where an estimated 20,000 residential, commercial, and industrial consumers are expected to be served in the future.

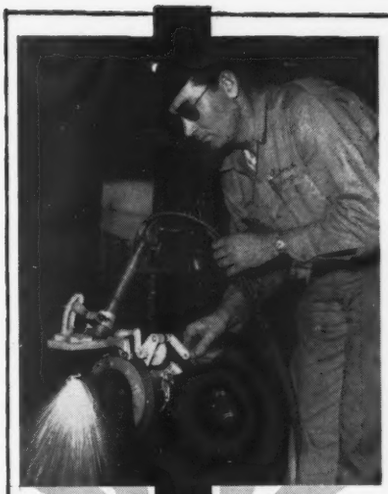


Brooklyn Union Gas Company, Brooklyn, New York, is underway with the number one item in its $17,900,000 1959 construction program with installation of two 6200 ft, 24-in. gas lines under the New York Bay. Known as The Narrows Crossing, the installation extends from New Lane and Bay Street in Rosebank, Staten Island, to 91st Street and Shore Road in Brooklyn. The new line will permit receipt of gas from Texas Eastern Transmission Corporation through the new 30-in. Clove Lakes line to be built by B.U. in Staten Island this year and will provide an alternate source of supply in event of an emergency affecting Transco's present supply line under The Narrows. Overall contract for the installation has been let to Samuel Galluci & Sons. Dredging for the trench in which the line will rest is being done by Arundel Corporation. Launching site in Staten Island for the 500 ft sections of ½-in. thick steel pipe have been prepared. Pulling the pipe into The Narrows will be done by Collins Construction Company. For the underwater crossing pipe has been triple-coated with enamel and covered with 2¾-in. of Hevicote. Consolidated Edison is assisting in the engineering phases of the project; assistant superintendent John Cohoon, Queens street section, distribution department, has been assigned as Brooklyn Union's engineer on the job.

Quebec Natural Gas Corporation, Montreal, Quebec, plans to construct a $5,000,000 natural gas line to cross the St. Lawrence River at Montreal to supply the South Shore area with first delivery of gas to Steel Company of Canada's new mill, scheduled for late August. The new line will connect with the main trans-island line built last year by Quebec near Delorimier Street and Metropolitan Boulevard, and will extend to the river in the vicinity of the Jacques Cartier bridge.

Milwaukee Gas Light Company, Milwaukee, Wisconsin, has construction underway on an undetermined amount of 2 to 12-in. main extensions in Milwaukee, Wisconsin, as part of its $11,000,000 construction program set for 1959. Work in Milwaukee is being done by Gabe's Construction Company of Sheboygan, Wisconsin.

Savannah Gas Company, Savannah, Georgia, has construction underway on the installation of natural gas distribution systems in Springfield, Rincon, and Guyton, Georgia. Contractor for the project, Latex Construction Company, has scheduled completion by July.



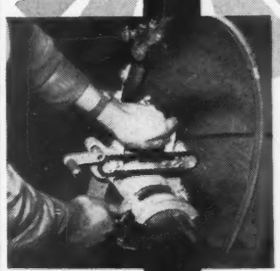
the best things come in small packages

. . . for example, consider the **new, improved** H&M Model "O" — the first pipe cutting and beveling machine especially designed for work on small diameter pipe.

The **new** Model "O", 7½ pounds of precision equipment, makes fast work of cutting and beveling 1½" to 4" pipe. One operator can easily handle this versatile unit, and completely perfect bevels are assured from the moment the torch is fired up . . . even with non-skilled operators.

H&M PIPE BEVELING MACHINE CO.

Trademark Reg



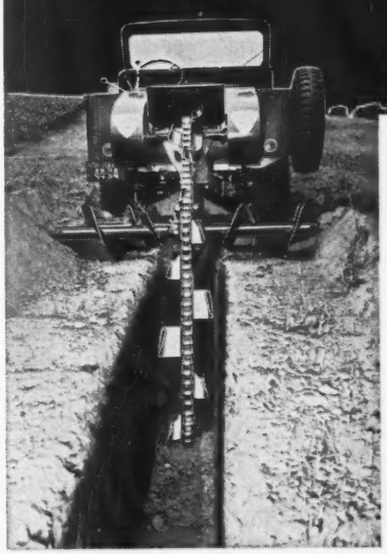
Pat. No. 2813342

The Model "O" is just one of seven H&M machines designed to meet your pipe cutting and beveling needs on 1½" to 36" pipe. Write for illustrated catalog and specification sheets.

The Model "O" features fast, easy mounting. Quick operating snap-chain fasteners make it possible to move the machine in a matter of seconds.

311 EAST THIRD ST. Diamond 3-0241
TULSA, OKLAHOMA

LET AUBURN TRENCHERS CUT your TRENCHING COSTS!



If you want your trenching done at less cost, and with less trouble, you want **Auburn.** This simple, time- and customer-proven machine digs where other trenchers won't even start. It has a variable speed, hydraulic drive that automatically adjusts speed to changing soil conditions, and it operates up to 800 feet per hour. **Auburn** costs less to own, requires less maintenance, seldom has any downtime, and is one-man operated. It has interchangeable digging bits and boom that let you dig from 6 to 14 inches wide, down to 6 feet deep. Special digging bits are available for rock, shale, and frozen ground.

WE TRENCH THE EARTH

Auburn is the world's largest producers of trenchers.

AUBURN GEAR-DRAULIC

Tractor-mounted trenchers are available for M-F Work Bulls, IH Utility, John Deere Crawler and Wheel Industrial, and Ford Tractors.

Jeep-A-Trench GEAR-DRAULIC

the original Jeep-mounted trencher, and only trencher approved by Willys Motors. Available at Jeep Dealers.

WRITE FOR COMPLETE INFORMATION and DEALER'S NAME (2000 SOUTH "J" STREET)

AUBURN MACHINE WORKS, INC. AUBURN, NEBRASKA, U.S.A.

SERVICE IS NO SECRET AT SPI
No secret to our customers for they know through experience that they can count on SPI to make deliveries of perfectly processed pipe where it is wanted and when it is wanted.
And no secret to our employees for everyone at SPI is constantly aware of the fact that their primary assignment is to produce c/w pipe exactly according to SPI's rigid Standard Procedures and to ship it to our customers where and when it is needed.
Count on SPI for service . . .
SP
standard pipeprotection inc.
3000 SOUTH BRENTWOOD BLVD. • ST. LOUIS 17, MO.

Distribution Developments

Union Gas Company of Canada Ltd., Chatham, Ontario, commenced installation of approximately 60 miles of 2 through 8-in. main line extensions in Ontario in June. Contractor Harvey B. White, Ltd., estimates completion date to be September 1.

Winnipeg Central Gas Company, Winnipeg, Manitoba, has underway construction of 41,000 ft of 12-in. city perimeter loop which will eventually be a closed circuit surrounding the urban areas of Winnipeg and from which all laterals and distribution mains will draw. Completion date is scheduled for July 1959. Contractor is Mannix Company, Ltd. This is part of Winnipeg's $4,700,000 1959 construction program that will involve about 100 miles of mainline, distribution mains, and laterals for the Greater Winnipeg area. Company plans to install between 10,000 and 11,000 individual services this year as part of its market saturation policy. Distribution mains and laterals will be 2 to 8-in. pipe. G. M. Gest, Ltd. contractor, has just completed laying a crossing of the Red River for the loop line, consisting of 950 ft of 12-in. main with 39 cast iron split-collar type river weights on 24-ft centers, weighing 1830 lb per pair. Unusual feature of the river crossing construction was the use of a conveyor belt on a portable mounting to handle the 22-in. river ice as it was cut with power saws to form a 40-ft channel to operate a ditching barge. As each cake of ice was cut with the saw, men with pike-staffs pushed it onto the lower end of the conveyor belt which carried it over onto the down stream side of the channel where it was bulldozed out of the way. A ditch was cut to between 6 and 7 ft in the river bed to provide a 4½ ft minimum cover. Backhoe was used on a welded steel pontoon barge to ditch across the 681 ft of open water.

Consumer Gas Company of Toronto, Ontario, has construction underway with 35 miles of 2 through 8-in. main line extensions in Ontario scheduled for completion by September 1. Work is being done by contractor crews of Harvey B. White, Ltd.

Iowa-Illinois Gas & Electric Company, Davenport, Iowa, completed installation of 7 miles of 6-in. main extension in Moline, Illinois, in June. Under construction, and due for completion by October 1 are 30 miles of 2 to 12-in. main extensions in Cedar Rapids, Iowa. Work being done by contractor crews of Gabe's Construction Company, as part of Iowa-Illinois $5,481,000 construction program for 1959.

Now! An all-bronze replacement

MUELLER® *inverted key gas curb stop*

. . . for use with copper service lines!

Now you can use Mueller inverted key gas curb stops when replacing old, dangerous ¾″ iron pipe service lines with new ½″ copper pipe. Simply cut out the old curb stop, push the new copper pipe through the inside of the old iron pipe, and connect a Mueller H-11309 Curb Stop to the new copper pipe.

This new Mueller Curb Stop is similar in design to Mueller's well-known Inverted Key curb stops. All of the superior features of this excellent design have been retained. However, this new stop, specifically designed for use with copper pipe, is of all-bronze construction to eliminate dissimilar metals and reduce corrosion caused by galvanic action.

This special application product is typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product made for the gas industry.

Write for complete information.

H-11309 Inverted Key Gas Curb Stop
All-bronze with Straight Way and Flat Head
Inlet and Outlet: Dresser Coupling Style 88 for Type "K" Copper Pipe
Size: ½″ only

NO-BLO®

GEM

MUELLER CO. since 1857 SERVING the Water and Gas Industries QUALITY

MUELLER CO.
DECATUR, ILL.

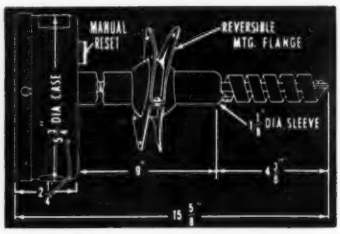
Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

MERCOID®

HIGH TEMPERATURE LIMIT CONTROL

FOR OVENS, DRYERS, FURNACES

FM
APPROVED



Type MX-51R

Semi-Automatic with Hand Reset

Mercoid Type MX-51R is an adjustable indicating type high temperature limit control actuated by a coiled bimetal element to result in a normally closed mercury (tube type) switch opening in event the supervised temperature reaches the preset limit point. An externally operated manual reset knob is arranged to reset the mercury switch after high temperature operation and normal temperature restoration.

The prevailing temperature and limit settings may be observed on the calibrated dial thru the glass fronted cover.

SPECIFICATIONS

Type MX-51R: SP-ST circuit opens automatically at the preset control setting on temperature rise. Manual reset provided to restore switch to closed position after temperature falls.

(Available SP-ST—circuit to close automatically at the preset control setting on temperature drop. Manual reset restores switch to open position on temperature rise.)

OPERATING RANGE

Adjustable: 50 to 650°F.
Minimum Differential: 20°F.

ELECTRICAL RATING

a-c or d-c: 10A. 115V., 5A. 230V.
Available on order 3A. 440V.
Electrical connection: ½" opening for conduit or BX.

WRITE FOR BULLETIN
SEB-51

THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.
New York: 205 E. 42nd St. - Philadelphia: 3137 N. Broad St.

PROFESSIONAL DIRECTORY

EMPIRE GAS ENGINEERING CO.
P. O. Box 1738.
Atlanta 1. Georgia

LP-gas peak shaving and stand-by plants for
- municipalities
- industry
- design
- construction

DRAKETOWN PROPANE PLANTS
STANDBY
PEAK SHAVING
100% TOWN or PLANT SUPPLY
- Design
- Engineering
- Construction

DRAKE & TOWNSEND Incorporated
11 WEST 42ND STREET, NEW YORK 36, N. Y.

Engineers, Designers and Manufacturers of
LP-GAS STAND-BY PLANTS
and special equipment for every requirement

BUTANE AIGAS PROPANE
TELEPHONE TRINITY 0845

AMERICAN LIQUID GAS CORPORATION
1109 Santa Fe Avenue • Los Angeles 21, California

BLACK & VEATCH
CONSULTING ENGINEERS
Natural Gas, Electricity, and Water Utilities
Production, Transmission, Distribution
Reports, Design, Supervision of Construction
Investigations, Valuation, and Rates
1500 Meadow Lake Parkway, Kansas City 14, Missouri (Since 1915)

COMMONWEALTH

SERVICES INC.
Management and Business Consultants
300 Park Ave.
New York 22, N. Y.

ASSOCIATES INC.
Consulting and Design Engineers
209 E. Washington
Jackson, Michigan

OTHER OFFICES:
1 Main Street
Houston 2, Texas

1612 K Street N.W.
Washington 6, D.C.

WHITMAN, REQUARDT AND ASSOCIATES
Engineers
Design—Supervision—Reports—Valuations
Publishers of the
HANDY-WHITMAN INDEX OF PUBLIC UTILITY CONSTRUCTION COSTS
now in its 35th year
1304 St. Paul Street — Baltimore 2, Maryland

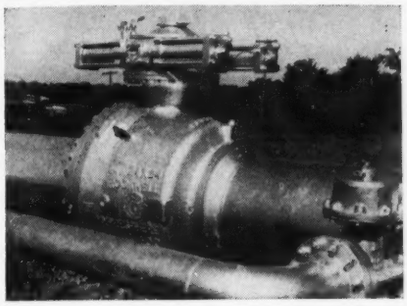
APCO PROPANE-AIR MIXING SYSTEMS
Full Standby or Peak Shaving
Simple — Accurate — Rugged — Reliable
Package Units . . . Starting Service Included
Applied Engineering Company
P. O. Box 506 — Orangeburg, South Carolina

LEAKAGE CONTROL SURVEYS
- Provide SAFETY & a 3rd Party Audit
- Reduce unaccounted—for losses
- Assist in economical & effective maintenance + repairs
- Conserve & protect Natural Resources

HEATH *Survey Consultants, Inc.*
378 Washington St., Wellesley Hills 81, Mass.

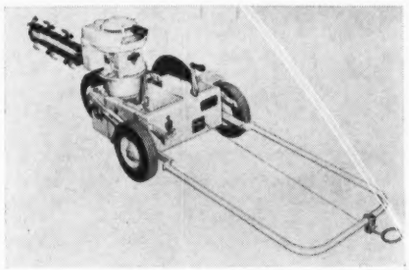
PRODUCT PARADE

MATERIALS – EQUIPMENT – SERVICES



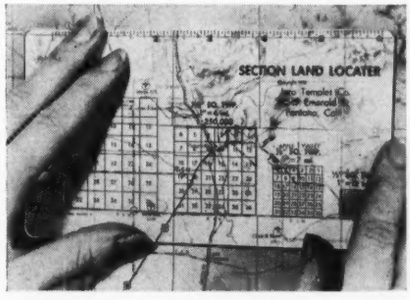
SPHERICAL-TYPE VALVES, particularly suitable for gas lines, are now available from Rockwell Manufacturing Company. Field tested for more than 5 years, the new round bore, full-opening Hypresphere valves are less than half the height of conventional conduit gate-type valves. Constructed of carbon steel, valves have 4 main parts — operating stem, ball plug, two spherical ring seats, and the body housing. Only the operating stem and ball plug are moving parts.

CIRCLE (1) ON THE REPLY CARD



DAVIS "PUP"—a new portable, self-propelled utility trencher now being manufactured by Davis Mfg. Inc. is especially designed to prepare trenches for gas lines from the main to a building, and for installing outside gas lights. Unit trenches from 2 to 3-in. wide to depths of 3-ft. Once started, operator is not needed except for casual observation and to stop unit. A positive, variable speed drive with unique winching mechanism draws Pup down the line to be dug. Six different speed settings, as well as neutral and stop-forward motion, are controlled by single lever. Unit attains speeds up to 400 ft per hr.

CIRCLE (2) ON THE REPLY CARD

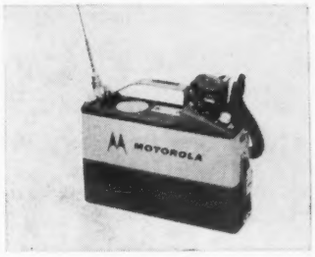


SECTION LAND LOCATOR. Transparent plastic template helps locate any section of land on township maps. Fits eight most commonly used map scales, four on each template. Convenient size — 3¾ by 6¾-in. — fits pocket or ring binder.

CIRCLE (3) ON THE REPLY CARD

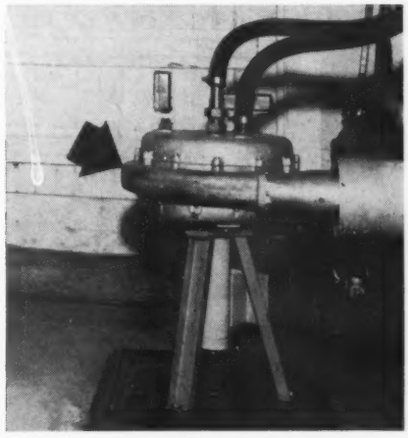
MINNESOTA MINING AND MANUFACTURING COMPANY has announced a chemically-inert tape designed to seal and permanently lubricate pipe joints. An unfused film tape, available in 3 and 4 mil calipers, Pipe Sealant Tape (No. 547) can be applied in seconds and conforms to all types of pipe threads and fittings. Tape is made with a "Teflon" TFE-fluorocarbon resin, and can withstand processing temperatures from the liquid-oxygen range through that of superheated steam. Non-adhesive, tape is sufficiently cohesive to stick to its own surface.

CIRCLE (4) ON THE REPLY CARD



MOTOROLA HAS INTRODUCED a new "Private Line" "Handie Talkie" portable radiophone that is a portable two-way radio unit designed to block out annoying interference caused by other radio systems on a users channel. Available in low and high powered versions in both 25-50 mc and the 144-174 mc frequency bands, unit can be operated from long lived dry cell or rechargeable nickel cadmium interchangeable battery power packs. Units vary in weight from 7 to 18 lb depending on power of unit and type of battery.

CIRCLE (5) ON THE REPLY CARD



COLD WATER TO 100-PSIG STEAM in 15 seconds is now possible with new type package "boiler," whose weight and volume are only one-sixth that of an equivalent conventional unit. Design of Turb-O-Heat generator unit is based on entirely new concept — a fin-and-tube heat exchanger section rotating at high speed (3600 rpm) within the casing. Centrifugal force on the fluid in the tubes promotes rapid flow through the tubes, resulting in a high rate of heat transfer — better than 300,000 Btu per hr. Unit is 20 by 20 by 30-in. high; weighs 150 lb.

CIRCLE (6) ON THE REPLY CARD

A

BILLION

cu. ft.

LEAK!

If all the leaks Southern Cross Foresters located and repaired in 1958 were combined the result would be a colossal *billion cu. ft. per hour* leak!

Vegetation Method, Safety and Combination Surveys by SCF will find your unaccounted-for. Fully equipped, thoroughly experienced repair crews will make your repairs without forcing you into costly build-up of equipment and personnel. We would like to tell you more.

SOUTHERN CROSS FORESTERS

Atlanta 6, Ga. ME 4-4227

DRAGNET

leak detector

detects and locates leaks on any pressure piping system in a matter of minutes!

PATENTS PENDING

Here's the newest time-saver in the industry! The compact, portable Dragnet Leak Detector will detect even the tiniest leak on any pressure piping system for gas, steam, water or refrigeration. Unique "bubble action" principle much faster than by using pressure gauge or manometer.

SEND FOR BULLETIN 545

UNIVERSAL

CONTROLS CORPORATION

P. O. Box 13122

Walnut Hill Sta. — Dallas, Texas

NEW SOLID BRASS GAS LAMP featuring a convertible burner that can change from mantle flame to a dancing flame by inserting an adapter, is now available from M-J Products of Los Angeles. Unit has all riveted construction, is 10-in. wide by 16-in. overall height; available in satin black or weathered brass finish. Post comes in 84-in. overall length.

CIRCLE (7) ON THE REPLY CARD

Said one crazy twin to the other: If it weren't for me you'd have two heads.

BRASS INSULATING STREET TEE

developed by Dresser Manufacturing Division employs same time-proved compression sealing principle as Dresser's other Style 90 fittings for gas service piping; is recommended for use in place of malleable street tees on cast iron mains where excessive corrosion is a problem. Tee is cathodic to cast iron pipe, and insulated from steel service line, thereby providing long life connection with positive insulation between the two structures.

CIRCLE (8) ON THE REPLY CARD

NEW IN PRINCIPLE!
NEW IN DESIGN!

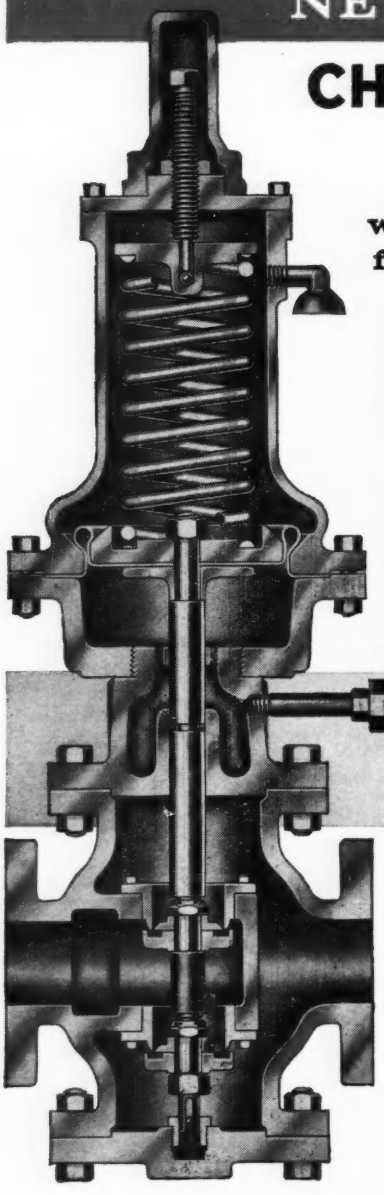
CHAPLIN-FULTON

Model 57-S

GAS REGULATOR

with "ROLL-OUT" Diaphragm

for constant pressure control

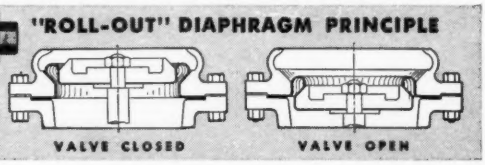


Chaplin-Fulton Model 57-S is a simple spring loaded regulator which performs like a pilot loaded regulator, without the added complications. For pounds-to-pounds service—inlet pressures to 400 psi—controlled pressures to 75 psi, with deviation through full valve travel less than 1 psi.

NO "FALL-OFF" AS FLOW INCREASES

The drooping characteristics or outlet pressure "fall-off," typical of conventional spring regulators, is eliminated—not by using an uncontrollable velocity effect—but by a new diaphragm design which actually reverses the action of a conventional diaphragm. It changes its area as the valve opens to compensate for the loss in spring loading force.

"ROLL-OUT" DIAPHRAGM PRINCIPLE



Note how, with the valve upwards in the closed position, the diaphragm achieves its maximum effective area—and decreases as the valve opens. The area changes at the same rate as the spring loses compression, to give a constant controlled pressure—determined entirely by valve movement.

2" - 3" - 4" - 6"

Write for Bulletin 57-S

ACCURATE CF MFG. CO. DEPENDABLE

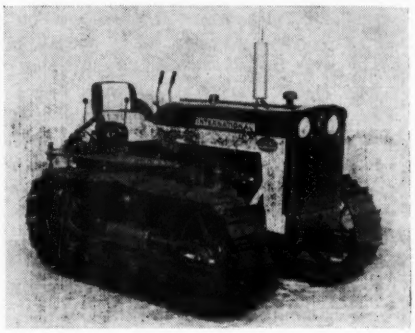
Chaplin-Fulton

MANUFACTURING COMPANY

Pittsburgh 25, Pennsylvania

NEW SENSING UNIT, marketed by Minneapolis-Honeywell Regulator Company, detects presence or absence of cryogenic liquids or fuels in a transfer line or vessel. Applications include use in liquefied methane plants. Sensor is a three-part control unit consisting of a detector probe, amplifier, and connecting coaxial cable. Probe detects level of liquid gases and fuels within one-sixteenth inch or less, and will withstand maximum pressure of 250 psi at —297 F and liquid velocity of 18 ft per second.

CIRCLE (9) ON THE REPLY CARD

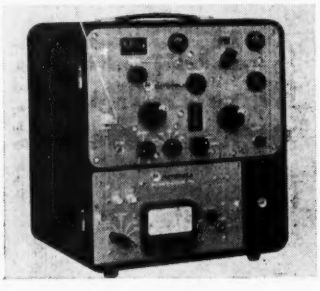


NEW CRAWLER TRACTOR with 31 drawbar horsepower, that gives a pull of 5320 to 8000 lb, depending on weight and traction, has just been put in production by International Harvester. New 5600-lb crawler is designed primarily for industrial and commercial use on projects on uncertain terrain, including hillsides, mud, etc. Full line of attachments available.

CIRCLE (10) ON THE REPLY CARD

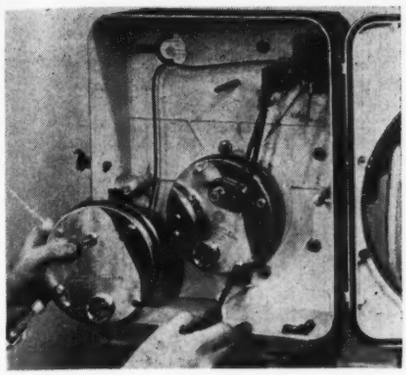
AMERICAN LIQUID GAS CORPORATION has announced Factory Mutual Approval of their ALGAS direct-fired combination LP-Gas vaporizer-mixers that are used for utility service, peak load shaving, and utility or industrial stand-by plant service. Unit maintains automatic control of mixed gas production and heating value without depending on electric power. Turn down is 100 percent. Packaged unit will produce up to 10,000 std cu ft per hr of LPG-air mixture at pressures up to 5 psig. Four other sizes are available, ranging from 2500 to 50,000 std cu ft per hr mixed gas capacity.

CIRCLE (11) ON THE REPLY CARD



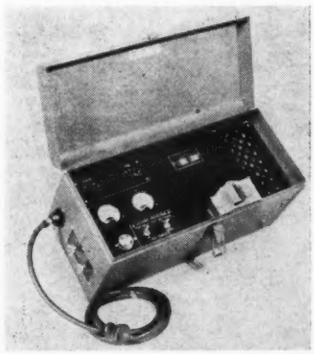
PORTABLE, ALL-BAND FREQUENCY AND DEVIATION METER for servicing two-way radios and other communications equipment is now available from Motorola. Frequency meter provides variable signal measurement and generation capabilities from 20 mc to 1000 mc with calibrated plus or minus .0001 percent accuracy. For deviation measurements, unit provides dual range meter with 7.5 kc and 15 kc deviation scales. Entire instrument measures 15 by 12½ by 13 in., weighs 40 lb, and requires only 75 watts at 115 VAC power.

CIRCLE (12) ON THE REPLY CARD



NEW GAS-DRIVEN CHART DRIVE, a completely self-contained air or gas-powered instrument drive and timing unit, has been introduced by Rockwell Manufacturing Company. Unit provides power for accurate, automatic operation of recording charts in many instruments including orifice meters, gas lift intermitters, pressure recorders, and temperature gages. Particularly applicable for remote location installations where it is not always possible to manually wind a standard chart drive. Unit is self-starting, explosion proof, and the timing mechanism is internally sealed to prevent corrosion and clogging.

CIRCLE (13) ON THE REPLY CARD



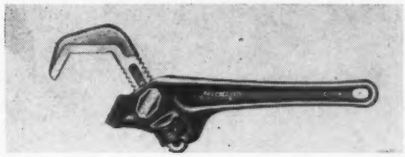
CATHODIC PROTECTION PORTABLE TEST RECTIFIER, now being produced by Harco Corporation, provides adjustable d-c output on a timer-interrupted cycle, or continuously without use of automotive batteries, bulky cabinet rectifiers, and similar unwieldy sources of d-c power. Unit consists of a transformer, selenium air-cooled rectifier, automatic built-in current interrupter, d-c ammeter, and voltmeter, is designed to operate from any 115-v a-c source, or gasoline motor generator; has a rated output of 54-v 20 amp for intermittent use, or 54-v 10-amp in continuous operation. Weighs only 50 lb.

CIRCLE (14) ON THE REPLY CARD

POLYKEN HAS INTRODUCED a new high-density polyethylene protective coating that is an extra-strength pre-formed, cold-applied tape coating for pipe, designed for application by tensioned-spindle wrapping machine. Tape has been field tested for two years. Tougher, more heat-resistant, but with same inherent stability and electrical and water insulation properties of conventional Polyken tapes, new "No. 960" requires no primer, no drying or cooling time, gives off no fumes, causes no fire hazards, and provides low installation cost.

CIRCLE (15) ON THE REPLY CARD

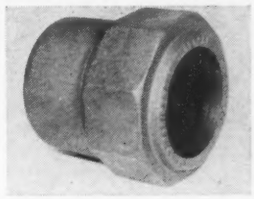
NEW RIDGID OFFSET HEX WRENCH, manufactured by Ridge Tool Company, is designed for use on hard-to-get-at fittings in tight quarters, has an



easy-on, non-slip, multi-side grip that gives extra leverage on all hex nuts, square nuts, valve packing nuts, unions, and gas cocks. Jaws have maximum opening of 2⅛ in. Ridgid hex wrench line now offers 5 wrenches for overall size range of ¼-in. to 2¾-in. nuts.

CIRCLE (16) ON THE REPLY CARD

NEW LOCK-TYPE LINE CAP developed by Dresser Mfg. Division, Dresser Industries, Inc., is the latest addition to Dresser's complete line of Style 90 fit-

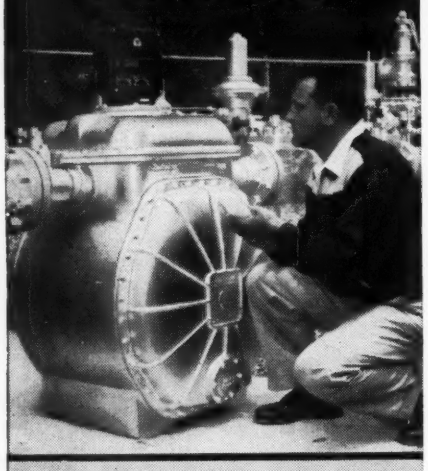


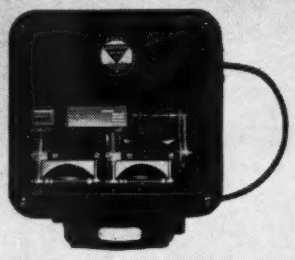
tings for gas service piping. Designed to provide safer, more rugged seal, new line cap minimizes danger of pull-out. Available in ¾, 1, 1¼ and 2-in. sizes.

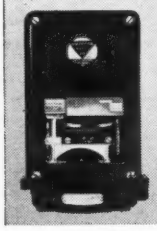
CIRCLE (17) ON THE REPLY CARD

time tested...
meter proved
Lancaster DIAPHRAGMS
complete assemblies • metal-rimmed • all-leather
Lancaster complete diaphragm assemblies for 1-A Sprague meters adjust to "watch-movement" accuracy regardless of case thickness or location of the main movement or carrier wire side bracket.
Grooved metal rims have added strength, rigidity. Leather is positioned in groove with precise machinery to assure uniformity of amount of leather and depth of pocket. Endless metal ring holds leather to rim with uniform pressure.
Lancaster-processed leather is soft, supple — yet firm, normally retains oil 20 years or longer.
All-leather, metal-rimmed or complete assemblies, Lancaster diaphragms improve accuracy, lengthen performance and minimize servicing.
Specify Lancaster for Sprague, Ironclad, Tobey and tin gas meters . . . and gas regulators . . . and use Lancaster's prompt repair service for Emco and Metric diaphragms.
"a meter is only as accurate as its parts"
Lancaster METER PARTS CO.
Manufacturers of Quality Parts for Gas Meters
POST OFFICE BOX 378 LANCASTER, OHIO
Canadian Representative: Ontor Limited, Toronto 2, Canada

FOR ACCURATE FLOW MEASUREMENT
365
DAYS A YEAR







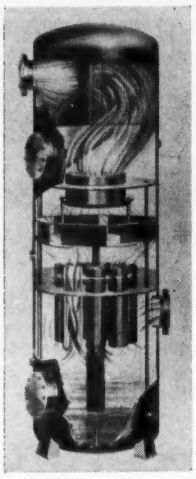
USE AMERICAN® BASE VOLUME AND BASE PRESSURE INDEXES

American BASE VOLUME INDEXES register gas quantity at standard conditions of base temperature and base pressure. BASE PRESSURE INDEXES automatically multiply volume at line conditions by the pressure factor and indicate quantity at base pressure on a straight reading index.

No computations...accurate gas volumes at base conditions are shown immediately. A second counter on the back indicates volume at line conditions. Simple operating principle... integration is continuous with all functions performed mechanically through special gearing.

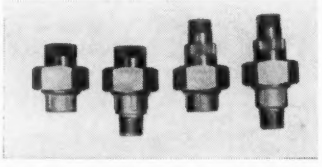
Write for Bulletins 200 and 201.

AMERICAN® METER COMPANY
INCORPORATED (ESTABLISHED 1836)
General Offices: Philadelphia 16, Pa.
Sales Offices in Principal Cities



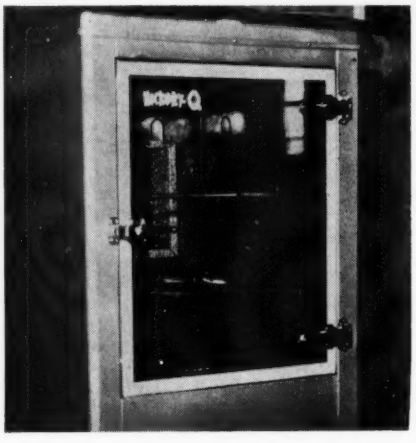
NEW GAS CLEANER for removing dust and oil at high volumes and extreme turn-downs in gas flow has been designed by Blaw-Knox Company. *Multi-Phase* unit provides complete dust-erosion protection to regulating and metering equipment. Dust is removed at low loads as well as rated capacity, making the cleaner, with its 4 phases of scrubbing, applicable to systems having wide hourly load swings as well as seasonal variations. Available in sizes from 18 to 72 in. in diameter for capacities up to 18,000,000 std cu ft of gas per hr (at 1000 psig) and for any desired design pressure.

CIRCLE (18) ON THE REPLY CARD



NEW LINE OF INSULATED UNIONS for gas service applications now available in any combination of female or male threaded ends in ⅜, ¾, 1 and 1¼-in. sizes from Eclipse Fuel Engineering Co. New unions end electrolytic corrosion of mains and services by providing completely effective protection from induced or stray house current, and eliminate need for special installation or high cost maintenance. Insulating material is DuPont's Zytel 105; suitable for continuous operation at 275 F. Unions recommended for working pressures up to 150 psig.

CIRCLE (19) ON THE REPLY CARD



NEW COMMERCIAL GAS ROTISSERIE—The Infra-Red Hickory-Q Rotisserie recently introduced by Suburban Appliance Company — cuts cooking time as much as 80 percent. Rotisserie incorporates recently developed ceramic gas burner that reduces cooking time and cuts fuel costs. Unit is sized for waist-high cooking and designed for use in either dining areas or kitchen, indoors or out. Dimensions are 24-in. deep, 30-in. wide, and 57-in. high.

CIRCLE (20) ON THE REPLY CARD

1897 1958

GOODMAN
USED SINCE 1897
2" HANDLE & LOCKING SLEEVE
GAS MAIN STOPPER

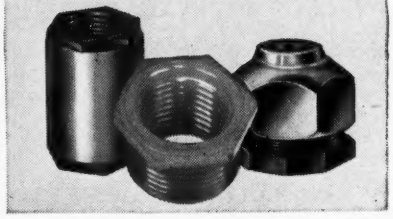
PIPE STOPPERS OF ALL KINDS

•

SAFETY GAS MAIN STOPPER CO. INC.

523 Atlantic Avenue
Brooklyn 17, N. Y.
Cable Address: GASTOPPER, N. Y.

PROTECT
mains, meters,
pipes, equipment,
and appliances with
MAYCO
Dielectric Fittings or
Dielectric Bushings



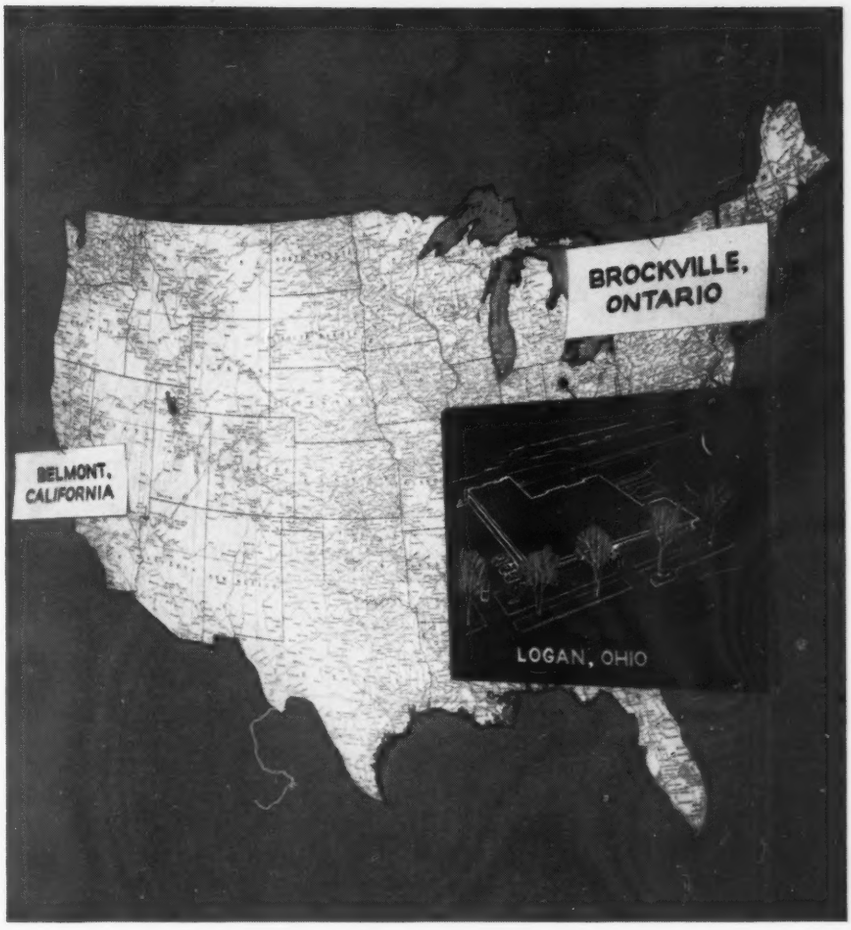
Stop electrolysis by insulating connections with MAYCO Dielectric Fittings or Dielectric Bushings. Bushings are toughest PLASKON nylon with extra-heavy "hex" gripping surface (on most sizes)...withstand pressures to 1000 lbs., temperatures to 300° F. Sizes to 2" for gas, plumbing, heating installations—wherever dissimilar metals are joined. Order from your jobber or write:

MAY PRODUCTS, INC.
GALESBURG, ILLINOIS
Manufacturers of MAYCO Dielectric Fittings
– MAYCO Water Softeners

ADVERTISERS INDEX

American Meter Company.....2, 10, 46
American Meter Company
Reliance Regulator Division.....—
Arkla Air Conditioning Corporation 37
Auburn Machine Works.....39
Barber-Greene Company 33
Bryant Manufacturing Company..... 9
Chaplin-Fulton Manufacturing
Company 44
Cleveland Trencher Company, Inc....11
Comfort Products, Inc.....—
Cook Machinery Company..... —
Dearborn Chemical Company..... —
Dearborn Stove Company..... —
Deere & Company.....—
Dollinger Corporation .....—
Dresser Industries, Inc.....—
Dresser Manufacturing Division ... —
Eclipse Fuel Engineering Co..... —
Fisher Governor Company..... —
Fisher Research Laboratory, Inc. .. —
Greenlee Tool Company.....—
Hays Manufacturing Company..... —
H & M Pipe Beveling Machine
Company 39
Frank G. Hough, The, Company.... —
Johns-Manville .....—
Kimray, Inc. .....—
Lancaster Meter Parts Co.....45
Lone Star Steel Company..... 6
Massey-Ferguson Industrial Division,
M-H-F, Inc. .....Inside Back Cover
May Products, Inc.....46
Mercoid Corporation 42
Mueller Co. 8, 41
Nibco, Inc. .....—
Norton-McMurray Manufacturing
Company .....—
Norwalk Valves .....—
Oronite Chemical Company.....—
Pipe Line Service Corporation.....—
Pittsburgh Coke & Chemical Company,
Protective Coatings Division.....—
Professional Directory 42
Reynolds Gas Regulator Company...12
Robertshaw-Fulton Controls Co.....4, 5
Rockwell Manufacturing Company,
Products Division .....—
Rockwell Manufacturing Company,
Nordstrom Valve
Division .....Inside Front Cover
Safety Gas Main Stopper Co., Inc....46
Sheehan Pipeline Construction Co....—
Sherman Products, Inc.....—
Skinner, M. B., Company.....13
Somerville Construction Co.....—
Southern Cross Foresters 43
Southern Pipe Coating Co.....—
Sprague Meter Company,
The .....Back Cover
Standard Pipeprotection, Inc.....40
Superior Meter Company..... 7
Tapecoat Company .....—
Tinker & Rasor.....37
Universal Controls Corporation.....43
William Wallace Company.....47
Wilkinson Products Company.....—

THIS INDEX IS PROVIDED AS AN ADDITIONAL SERVICE FOR OUR READERS — THE PUBLISHER ASSUMES NO RESPONSIBILITY FOR ERRORS OR OMISSIONS



METALBESTOS PUTS ANOTHER PLANT ON ITS VENTING MAP

A significant addition to the Metalbestos marketing network, this new plant in Logan, Ohio, is scheduled for mid-1959 completion. It follows closely on the heels of another production facility established last year: The Metalbestos Manufacturing Company in Brockville, Canada.

At its new Ohio plant Metalbestos will manufacture a complete line of gas vent and all-fuel chimney products. The result will be to expedite distribution and service to eastern, southern and midwestern customers.

In the words of William Wallace Company president, Alan Kinkead, "This is an important new link in our chain of plants, warehouses and factory representatives. It should materially assist those engaged in serving North America's heating needs."

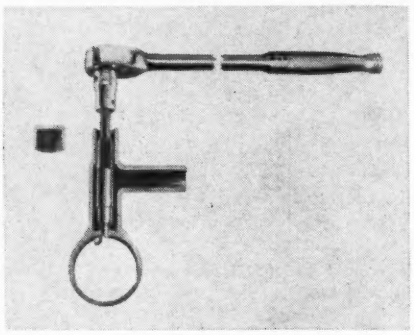
LISTED UNDER REEXAMINATION SERVICE UL OF UNDERWRITERS' LABORATORIES, INC.

METALBESTOS DIVISION

WILLIAM WALLACE COMPANY · BELMONT, CALIF.

BULLETIN BOARD

CATALOGS – BROCHURES – TECHNICAL DATA



M. B. SKINNER'S NEW "PUNCH-IT-TEE," a new method for taking services off mains is described in a newly-released circular. Tee incorporates a punch (up to ⅜-in. diameter) and positive shutoff. Eliminates need for drilling devices. Each tee is tested to 5000 psi hydraulic pressure and carries a "rated 1000 lb" label assuring a 5 to 1 safety factor. Made of steel similar to pipe, tee welds easily, or in the saddle model takes a perfect thread. Available in two sizes — ¾ and 1-in. Side outlet can be furnished ¾-in. or 1-in. with end bevelled for welding, threaded, or smooth for compression coupling.

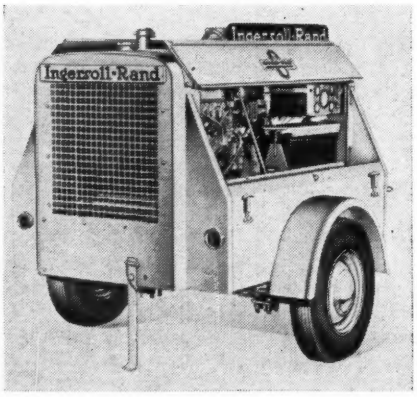
CIRCLE (61) ON THE REPLY CARD

KEROTEST MANUFACTURING COMPANY'S line of small valves for general application are described in newly-released section N of the company's new steel catalog KS-1. The 4-page brochure gives working pressures, specifications, construction features, and suggested applications.

CIRCLE (62) ON THE REPLY CARD

ABS RIGID PLASTIC PIPE FOLDER, recently released by Marbon Chemical Division, Borg-Warner, presents advantages of ABS pipe for gas lines and lists combination of 10 advantages found only in pipe extruded of ABS (acrylonitrile-butadiene-styrene). Title of folder is "Be ABSolutely Sure with ABS Plastics."

CIRCLE (63) ON THE REPLY CARD



INGERSOLL-RAND'S new 125-cfm "Gyro-Flow" portable rotary compressor is described in new 4-page bulletin. Smaller and more compact than the original Gyro-Flow 125, new unit has a simplified, more efficient compressor system, automatic drainage of oil from cylinders when unit is shut down; larger, more powerful engines; slower speed; safety shut down on compressor, and other features. Unit is 10 ft 1-in. long, 5 ft 1½-in. high, and weighs 2442 lb.

CIRCLE (64) ON THE REPLY CARD

BURROUGHS MODEL 205, medium size electronic data processing system, is described in new 4-page 2-color brochure from Burroughs Corporation, ElectroData Division. Among the exclusive capabilities of the 205 normally found only on the "giant" systems are: complete range of input-output media — paper tape, magnetic tape, cards, or keyboard; large internal memory of 40,800 digits; independent simultaneous operation of peripheral units; high operating speeds; simplified operation and maintenance, and modular expansion.

CIRCLE (65) ON THE REPLY CARD

CATHODIC PROTECTION SERVICES and materials now available from Corrosion Services, Inc., are described in new 2-color, 4-page condensed catalog. Described are engineering services available from CSI on corrosion problems on all types of buried or submerged structures; contract installation services including turnkey jobs; equipment such as rectifiers manufactured by Good-All Electric Mfg. Co.; Dow and National Graphite anodes and special type backfill; cathodic protection cables and cadweld welding kits; insulation and Polyken coating materials; and instruments handled by CSI such as pipe and cable finders, leak detectors, etc., manufactured by Fisher, Agra, Collins, and Nelson.

CIRCLE (66) ON THE REPLY CARD

CLEVELAND TRENCHER COMPANY'S three new model "J" trenchers, introduced earlier this year, are described in new 4-page folder. Text and series of simplified mechanical illustrations describe new models' revolutionary V-shaped discharge conveyor which is driven, shifted, and reversed in direction of discharge by independent hydraulic drives lever-controlled from operator's seat. Digging capacities, specifications, and dimensions of new models are compared on page 4 of the folder.

CIRCLE (67) ON THE REPLY CARD

VESTA GAS RANGES are illustrated and specifications given in a multi-color 16-page brochure now available from Athens Stove Works, Inc. More than 26 models are pictured. Special features are pinpointed and brochure's inside back cover points out scientific features that help sell today's homemaker including range-top griddle, burner-with-a-brain, drop-front broiler drawer, easy cleaning aeration pan and "no-stoop, waist-hi" gas broiler.

CIRCLE (68) ON THE REPLY CARD

NEW 2-COLOR BROCHURE describes with pictures and specifications Birmingham Manufacturing Company's line of "Totem-All" industrial tractor trailers. Units haul small crawlers, tractors with front-end loaders, back-hoes, trenchers and similar equipment to job site. Equipment rolls on easily and quickly by means of ramps.

CIRCLE (69) ON THE REPLY CARD

BOOKSHELF

Welding Handbook, Section II, Gas, Arc & Resistance Welding Processes, *4th edition, edited by Arthur L. Phillips, published by American Welding Society, 33 West 39th Street, New York 18, New York. Pages 550. Price, $9.*

Covers gas, arc, and resistance welding processes and equipment and includes a chapter on standard welding symbols. Each of the 13 chapters contains its own bibliography. A comprehensive index is provided at the back of the book. Separate chapters describe each process or group of processes, and are followed by a chapter describing the equipment used for the process described. For example, treatment of arc welding process includes chapters on carbon-electrode arc welding, inert-gas metal-arc welding, and submerged arc welding. This group of chapters is followed by a chapter on arc welding equipment. Chapter on welding symbols includes the revised standard welding symbols adopted in 1958 by AWS and the nondestructive testing symbols introduced for the first time last year.

Refractories Bibliography, 1947 - 1956, *compiled and supervised by Joint Refractory Committee of the American Iron and Steel Institute and the Refractories Institute. Published by University of Oklahoma Press, Norman, Oklahoma. Pages, 900. Price, $7.50.*

More than 9500 references and abstracts on the subject of refractories — raw materials, manufacture, application, and performance are listed. This new book supplements the *Refractories Bibliography: 1928 - 1947.* Valuable reference tool for persons interested in any phase of the refractories industry.

NFPA Inspection Manual, *2nd edition, edited by Horatio Bond, published by National Fire Protection Association, 60 Batterymarch Street, Boston 10, Massachusetts. Pages, 320. Price, $4.*

Revised and enlarged edition of guide for checking and improving safety of property against fire; data ranges from gas appliance connectors to extinguisher ratings and sprinkler requirements. Book is designed for use by engineers and inspectors; contains helpful information for the beginner and provides a selection of material that even experienced inspectors will have frequent occasion to consult. Inspection procedures, what to "look for" in various occupancies, heating hazards, inspection of protective equipment, and what "approvals" mean are discussed.

Phase Relations of Gas-Condensate Fluids — Correlations of Test Results and Component Properties, *Vol. 2 of Monograph 10, published by the American Gas Association, 420 Lexington Avenue, New York 17, New York. Pages, 523. Price, $15.*

Second of a two-volume monograph of special interest to reservoir and distribution engineers of the natural gas industry has just been published. Contains correlations of technical data obtained in 20 years of research conducted by the Bureau of Mines, U. S. Department of the Interior, in cooperation with the American Gas Association. More than 260 illustrations and 157 tables are included. Four chapters describe correlations of the phase diagram of gas-condensate fluids; correlations of the compressibility factor are presented in 3 chapters. Material and correlations of Volume 2 are based on data in Volume 1 and data taken from the literature. Descriptions of techniques and critical features of special apparatus are contained in nine appendices.

Can you see where you're DIGGING?

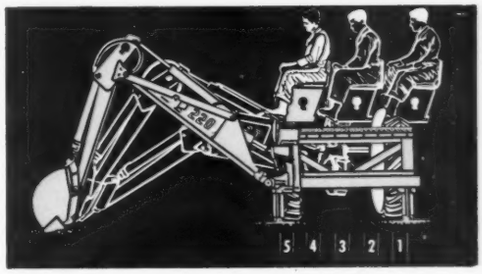
YOU CAN...with a DAVIS BACKHOE!

Massey-Ferguson's new Davis 220 Backhoe gives **exclusive "line-of-sight"** operation. In any digging position – flush left, flush right, in the center... even when dumping – the operator's seat is in line with the boom, the bucket is always in full view. You don't have to twist or stretch to see. The Davis 220 is designed to put you where you deserve to be – on top of your work and in line with it. You can do any digging job more accurately, faster, and with unsurpassed convenience and comfort.

Visibility is only one feature of the new Davis 220. Increased operating pressure to **2150 psi** with high-pressure fittings, tubing and hoses – **14,000 pounds breakout force** to dig through frozen ground and asphalt – **vertical stabilizers** for "mountain-goat" footing all add up to better performance. Of course Davis was the first backhoe to ever dig flush and to have a rotary cylinder giving 200° continuous operating arc.

NEW HYDRA-SLIDE POSITIONING with the *DAVIS 220*

The new Davis 220 features Hydra-Slide positioning to move the digging assembly (and the seat) to a flush digging position. It can be done in 5 minutes by simply loosening four bolts and sliding the mast assembly by actuating the boom and bucket cylinders. Total of 5 digging positions located along frame



No Wonder Davis Backhoes Are So Popular and So Profitable to Own.
See your dealer for an "on-the-job" demonstration, and ask him about the budget-priced Davis Model 185!

MASSEY-FERGUSON INDUSTRIAL DIVISION
1009 SOUTH WEST STREET • WICHITA 13N, KANSAS

BE SURE YOUR METERS ARE

EASY TO MAINTAIN

COMBINATION METER AND REGULATOR

BE SURE TO SPECIFY Sprague

The remarkably simple but dependable mechanism of the Sprague Meter saves you money two ways — First, you seldom need to make repairs because of Sprague's unique operating principle which practically eliminates wear. Second, Sprague simplicity makes servicing extremely easy — cuts your equipment and labor costs — speeds maintenance operations.

Start now to save money on maintenance and moderization. Be sure your meters are the easiest to maintain — be sure to specify Sprague.

Call or write your Sprague representative today.

The Sprague Combination Meter and Regulator is a compact dual-purpose unit which dependably regulates gas pressure and accurately measures the flow. It is neater looking, more efficient, and requires 60% less space than conventional arrangements.
The Combination is especially easy to maintain and inspect because of its basic simplicity and few moving parts. It will also save you considerable labor and material expense on conversion to a higher pressure system. Available in Iron Case or Aluminum Case. Sizes 175 and 240 cu. ft. Synthetic or leather diaphragms.

GEM

Sponsor of
"PLAYHOUSE 90"
on CBS-TV

THE Sprague METER COMPANY • BRIDGEPORT 1, CONN.

WESTERN BRANCH — LOS ANGELES 23, CALIF. REGIONAL OFFICES — DAVENPORT, IOWA • HOUSTON 3, TEXAS • SAN FRANCISCO 11, CALIF.